THE

AMERICAN NATURALIST

VOL. XXV. NOVEMBER, 1891. 299.

LANGUAGE AND MAX MÜLLER.

BY S. V. CLEVENGER, M.D.

THE talented linguist who has contributed the series on "Language and Thought" to the *Open Court* says: "Certain it is that no philosopher has as yet utilized the new facts which the science of language has placed at his disposal." As most of these new facts are but corollaries of the evolutionary theory, and as philology was revolutionized by that theory and put upon a sure foundation, the remark is incautiously made. Herbert Spencer pointed out paths for the philologist and anticipated much that has been proven; August Schleicher discusses in accordance with the theory of natural selection how the various forms of speech have developed and divided into dialects and species; and Wilhelm Bleek has dipped into the origin of language. Friedrich Müller's ethnography, which accords language the first place in racial determinations, supplanted the Blumenbachian division into five races, based upon the Semitic myth of descent from a single pair.

Language and speech are used interchangeably by Max Müller, though gesticulation is tacitly and finally directly included; and how proper this inclusion is the science of cerebral physiology fully shows, yet not a single allusion was made to this important field of research. Müller claims a place among the physical sciences for the science of language, though he seems to completely ignore brain anatomy, general physiology, ethnology, and other cognate sciences that interpret speech processes.

LIBRARY
RECEIVED
DEC 3 1891

There should be no underrating of the great value of Max Müller's work. He has built himself an enduring monument in his contributions to philology; but I affirm that his labor has been more in the line of polyglot grammar generally. It is no slur upon the value or extent of Müller's work to say this, for this department of philology is just as capable of being deeply mined as any other portion of human knowledge; but Müller has missed availing himself of what had been worked out by other thinkers.

That he has become entangled in the mere wordiness of some ideas is apparent in his stating that Darwin has shown the inappropriateness of the word species, but that he has substituted varieties in its stead. Müller admits genera and individuals, but neither varieties nor species. Now if there was one thing above all others that Darwin did make clear, it was the trashiness of all these terms, from genus to variety, when used in the olden fixation sense. Nevertheless, in chemistry, botany, zoology, and even where the arbitrary relative terms genus, species, and variety are indispensable, nothing is capable of absolute classification; for everything is relative. Even the vertebrates cannot be sharply set apart from the invertebrates, for we are compelled to include the notochordal animals without backbones among the vertebrates. What Darwin did was to show that species, the limbs of a tree, were not trunks of separate trees, but that twigs and branches were often undistinguishable apart.

Throughout Max Müller's writings he is handicapped by his exaggeration of the importance of his particular line of research carried on as an isolated study. Could he but have a fair knowledge of associated sciences, such as that of anthropology, anatomy, physiology, and zoology, the value of his work would be greatly increased, and his inferences would undergo radical changes. He seems to base everything upon the derivation of a word, and says that etymology should not be laughed at. Undoubtedly a careful study of vocabularies aids us in tracing the origin of races, but languages have always been in an eternal flux, even though the meaning of words may sometimes show the intention with which words were framed, and in a few instances

give an insight to the thoughts of Paleozoic people. Those who have lived with savages, and are familiar with the puerility of their conceptions and their disposition to incessantly invent words and then forget them, are able to estimate gibberish at its proper value. When Chicago was a frontier trading post, log cabins and tents domiciled the people. Frame houses took the place of these as the village grew. Occasional small brick houses appeared as the town spread out; but scarcely a vestige of any of these dwellings remains among the towering masonry of the Chicago of to-day, with its million and a quarter of inhabitants. Too little attention has been paid to the fact that a growing, living language receives accessions from all sides. Our modern English is a fearful jargon, combined from many ancient and modern languages, civilized and savage; and necessarily so will speech be with a people who are living, expanding, in a restless age, accumulating ideas from all parts of the world. It is a very common mistake of the theologically biased, who imagine that language had a directly divine origin, that simplicity of construction of a tongue indicates this and is to be admired; when the fact of the matter is, irregularity of declension and conjugation are invariably produced by the mingling of people who speak different languages.

The Australian savage language is exceedingly regular and simple, in keeping with its poverty of ideas. The Spanish language is probably the most beautiful, resonant, inflexible, of any of Latin descent. But what is there in the Spanish language? The inquisition, in destroying thousands of thinkers in that country, male and female, helped to fix and impoverish Spanish brains and tongues. There is always wanting a proper consideration of the fact that, so far from being dependent upon language, far too often language has deranged thought, introduced confusion where even the deaf and dumb have thought more clearly. Gesticulation is an important means of communication between savages, so much so that the Australian primitive people could not understand each other in the dark; and the Chinese frequently resort to writing to make themselves better understood.

Müller wishes language to be regarded as a physical science. Granting that it is such, why then should it be isolated from all other sciences? Chemistry would be lame indeed without physics; and what would astronomy be without either?

Berkeley was right in saying that words are often impediments to thoughts. They do in many cases convey wrong impressions. They are false symbols, and, being inadequate, choke the intellectual processes.

Huxley says that the sooner you forget the derivation of a word, and use it in zoology, etc., as a mere arbitrary associated name (*nomen proprium*), the better you are off.

The fact cited, that the Greeks had but one name for language and thought, is about as important as that the Cheyenne Indians have but one word for head and leg.

The illustration of Gambetta shows that by habit thinking can be elicited in some only by speaking. It is an exercise of the symbolic field; but how is it that we find some of our greatest thinkers most reticent? Sir John Hunter could express himself with difficulty, and the most voluble elocutionist or orator may have an empty head.

Müller is unequivocal in making thought inseparable from language and considering them identical. "We think in names, and names only," he says. Do we? What did Caspar Hauser name his guardian?

Hobbes is quoted approvingly in saying that "truth and falsity have no place but among such living creatures as use speech," when the fox and wolf resort to subterfuges, and dogs and cats know that playing is not in earnest.

He reduces all languages to a few words, and then turns his back upon what it indicates,—that man came from primitive stock. He states that "nature produces the greatest effects by the smallest means," and yet Müller turns to the supernatural to account for language.

The "bow-wow theory" is contemptuously disposed of, and "*clamor concomitans*" is not anatomically referred to as depending upon effort and air expulsion from the throat.

He is like a blind would-be botanist who tries to picture trees by listening to the wind blowing through the branches.

Attempt a word analysis of a single expression,—appearance of eyebrows, wrinkles, corrugations, depression or elevation of nose and mouth,—and reflect what cumbersomeness words entail upon thought.

What words does the momentarily rapidly performed face reading require? You see expressions of myriad kinds flitting over faces,—you read them, but not in words. You cannot or do not analyze them. The unconscious association of the expression with an impression, true or false, which that expression makes upon your mind, it is impossible to put into words.

Mill is referred to as making logic depend upon words. Now imagine the logical deduction of a soldier who sees a gun pointed at him, and hence reads himself an essay that ends in advising himself to dodge behind a tree.

"Dumb animals" cannot be denied thought, they do not even analyze consciously their impressions, yet they study conditions to advantage, make up their minds to act offensively or defensively without a word; the infant does pretty much the same, so do the deaf and dumb.

Passing now to demonstrate facts, making a study of the machine instead of the noises it makes, it is well known to physicians that the seat of language in the brain in right-handed people is in the left side a little in front of and above the ear. In left-handed people the location is upon the corresponding right side of the brain.

These facts have been ascertained by exceedingly simple means, an injury to those portions causing an interference with the speech function, sometimes to the extent of destroying it. This speech function may be wholly and totally obliterated by disease, and yet the individual may be capable of transacting business, buying, selling, and directing his affairs generally and intelligently. He may make a will disposing of his property, he may think deeply and correctly, and yet be unable to express himself by speech; and on the other hand thought may be badly deranged and the speech faculty may remain intact. If language and

thought develop together and symmetrically, then the voluble Blind Tom should be a pundit instead of the idiot which he is. The ability to write may be taken away from us by disease and the faculty for speaking be left unimpaired; and per contra aphasia, or speech interference, may exist without agraphia, or the loss of the ability to write. These facts alone tend to disprove Max Müller's dicta. But much more can be added. In the disease called chorea or St. Vitus's dance, if the derangement of the motions begins on the left side the speech is not affected until the right side also of the body is diseased. Although in a very severe case of chorea in a young lady of twenty two the patient told me that her thoughts were perfectly clear until she attempted to speak, and then she became confused, this does not indicate that her thoughts and speech were inseparable, but that when she voluntarily attempted to translate her thoughts into speech the want of coördination produced mental confusion, and consequently speech inability. The maniac thinks too fast to be able to connect his words intelligently. It is a pernicious notion that ideas depend upon words; but "object teaching" alone disproves it. The senses may know things better than words can express them. We know that we can understand objects better by seeing, feeling, etc., rather than by description. Words indicate things; but we have to understand what those words mean first, showing that understanding precedes words. Language may in some increase the capacity for higher thought, but language cultivation alone does not increase thoughtfulness. The gymnast is not a watchmaker or pianist, nor is the elocutionist an originator. The talking ability of the parrot may be cultivated to its highest extent, but that bird will remain as thoughtless as any of his dumb ancestry.

When the right side of the body is paralyzed the speech ability is usually lost at the same time, and the mind may or may not be involved; but when the left side is paralyzed the speech is not impaired unless the patient is left handed, and the mind is less apt to be affected in left-sided paralysis.

An arm, a leg, one side of the face may be paralyzed, with or without speech disease, from brain injury, depending upon the

part of the brain affected. Certain areas of the brain preside over voluntary control of fingers, arms, legs, lips, lungs, etc., and movements of these to perform intelligent coördinate action are regulated by spots of brain surface called centers, which are nourished by special blood vessels. According to the extent of damage to these vessels will be the degree of paralysis, whether restricted or general, involving one or many bodily parts.

Slanting diagonally downward and forward in the outer part of the brain, just above the ear, lie these centers that control the arm, leg, fingers, and speech parts, and this portion has been appropriately termed the "symbolic field," because through its exercise and integrity man is able to gesticulate, point, threaten, with hands or feet, or to regulate the motions of the diaphragm, larynx, tongue, lips, in a comparable manner, to produce conventional sounds that serve better purposes than making gestures, but to the same end,—to make himself understood. It is difficult for us to consider the regulation of sounds into language as equivalent to gesticulation, but nevertheless nature makes but little distinction between her methods of symbolizing in these ways. The savage uses gestures where his speech centers are poorly educated, and the linguist represses his use of bodily contortions because his words can make him better understood. The ear has been trained to understand the minute variations in sound involved in speaking, where previously the eye interpreted less satisfactorily the symbolic movements.

And just as the symbolic field develops in man, so that part of the brain was built up and lifted the forehead into a more upright plane. But the fact that this symbolic field may be destroyed and thought remain shows that thought is not centered in that part, but is merely associated with it. To a great extent the mentality resides in the left frontal lobe, just in front of this symbolic field. This part may develop with or independently of the speech, leg, or arm centers, proving that thought is not language, but that language is merely a means of expressing thought, just as any other gesticulation is.

The baby's movements are at first badly regulated; he kicks, sprawls, and throws his arms, often in the wrong direction, when

he attempts to grasp some object. He merely denotes pleasure and pain in general by laughing and crying. Little by little the infant regulates his movements for walking and handling, and acquires the ability of pointing at or motioning away persons, denotes pleasure by nods and smiles, and displeasure by shaking his head or turning away, and soon he begins to articulate such words as "go way," "lemme alone," etc.

Nothing could be simpler and more convincing, by way of refutation of Müller's position, and innumerable facts of the kind could be additionally brought forward to demonstrate that thought is one thing and language another, and that he might as well say that thought is gesticulation of all kinds, for language is, after all, only gesture of vocal parts.

An important inference from this is that manual training would develop the symbolic field of the brain and afford a basis for mental development, where purely linguistic studies would tend to create inefficiency by crowding the speech center with symbols that are seldom used, comparable to the differences in education and usefulness that exist between the skilled mechanical engineer and the clownish contortionist.

THE PERMIAN, TRIASSIC, AND JURASSIC FORMATIONS IN THE EAST-INDIAN ARCHIPELAGO (TIMOR AND ROTTI).[1]

BY AUGUST ROTHPLETZ.

TWO years ago my friend Wichmann, professor in the University of Utrecht, in Holland, sent me a rich collection of Mesozoic and Paleozoic fossils, which he had made during his geological exploration of the Dutch colonies in India, in 1888-'89. All these fossils came from the west side of the island of Timor and the little neighbor island of Rotti.

Timor is a locality well known for Carboniferous fossils, which were described in 1865 by Professor Beyrich, in Berlin. He knew then eighty species from a little river near Kupang, and from another place one Ammonite, which he considered as a representative of the Mesozoic fauna. But Professor Wichmann found nearly the same Ammonites in the Paleozoic strata of that little river near Kupang. Therefore we must regard all these Ammonites as of Paleozoic age.

Though Triassic strata are not yet known at Timor, they have been found on Rotti by Wichmann, with the shells of European species of Monotis and Halobia; and in the mud of a volcano have been included, together with some Paleozoic fossils, like those of Timor, a few truly Jurassic remains,—also in part of European character. From the Paleozoic strata I know at present forty-three species, of which twenty-five are not yet known from any other country. The other eighteen only give us the opportunity to make out the exact age of these deposits. I shall mention them especially:

Six species are spread out over many parts of the earth and during many epochs of the Carboniferous and Permian periods: *Spirigera royssi*, *Spirifer lineatus*, *Spiriferina cristata*, *Productus semireticulatus*, *Fenestella virgosa*, and perhaps *Amplexus coralloides*. Three species are found in the Upper Carboniferous and Per-

[1] Read before the American Geological Society, August 24th, 1891.

mian strata of India, and in part of Russia: *Terebratula himalayensis, Retzia grandicosta*, and *Spirifer musateheylensis.* Nine species at least belong only to the Permian period, and seven of them have been found in the Salt range of India, three in Armenia, and one in Russia.

So we have in Timor no species which could be considered as of exclusively Carboniferous age (except perhaps *Amplexus coralloides*), but nine species of exclusively Permian age; and therefore we cannot doubt that the fossiliferous Paleozoic strata of Timor belong really to the Permain period.

In favor of this opinion may also be mentioned the presence of Ammonites, which are not yet known as having existed in the Carboniferous period. The *Ammonites megaphyllus*, which was described by Beyrich, and placed, together with the Triassic *Ammonites farbas*, in a particular group, has since played a remarkable part in the story of systematic arrangement.

First it was raised by Mojsisovics to the rank of a head of the genus Megaphyllites, in 1878. But after a few years the head got disgusted with his family, and fell in love with a young American lady, called by Hyatt *Propanoceras* (1886), in whose bonds he remained but a very short time, for he had become a very fickle fellow, and was running after some other Russian and Italian ladies, as Waagenia, Waagenina, and Stacheoceras. But these seem to have been only transitory passions, and, becoming older and calmer, he found at last the harbor of the genus Arcestes, where I hope he will pass his days peacefully, together with his new compatriot, the *Arcestes tridens.*

Now we have to consider another very interesting fact: that none of the exclusively Permian species of Timor occur in Australia or America. This seems to prove that Timor was a part of that Permian sea that covered the northern part of East India, Armenia, and Russia, and which was limited at the south, and perhaps at the east too, by that old Australian-Indian and African continent on which, in the same time, the wonderful Glossopteris flora was growing.

So also no near relations exist with the middle and northern parts of Europe. The European flora and marine fauna of the

Permian period is more distinguished from the Carboniferous flora and fauna by the dying out of older species and genera than by the growing up of new types. It looks as if Europe, with her shallow seas and her isolated and often inundated land masses, had been at that time the refuge for the Carboniferous world, which was retiring from the battle with younger and stronger people that came in from the east and south.

Therefore, if we would become acquainted with the true Permian flora and fauna, we must not address ourselves to Europe, but to the eastern and southern continents. There we find the marine fauna in a free and rich developement like that which we are accustomed to see in the Lower Carboniferous period in Europe; and this gives to the eastern Permian fauna an appearance by which it looks more related to the older Carboniferous than to the contemporaneous Permian fauna of Europe. Some geologists have been really disappointed by that appearance, and take the true Permian fauna as the development of a separate period that existed between the Carboniferous and the Permian periods, and which they have called the Permo-Carboniferous period.

But in this they are quite wrong. The aggregation of Carboniferous and Permian species in the fauna at the beginning of the Permian period is nothing extraordinary or nothing that should not be expected. We know the same as existing on the boundaries of the Triassic and Liassic, of the Jurassic and Cretaceous, of the Cretaceous and Tertiary periods. The fact is sufficiently marked by the names of Rhætic and Infraliassic, of Tithonic and Berrias, and of Laramie.

The Triassic formation is represented on the island of Rotti by white, gray, and red limestone plates, sometimes full of bivalves, Except one new species, *Halobia wichmannii*, I could state the presence of six European species: *Monotis salinaria*, *Halobia lommeli*, *lineata*, *charlyana* (syn. of *mediterranea* Gemallaro), *norica* and *Daonella cassiana*. All are representatives of the upper Alpine Trias, three have also been found in Sicily and two in the Himalaya. Therefore we must suppose that, as in the Permian period, so also in the Triassic time, a large sea-basin existed that covered and united Europe and East India.

But as the Permian fauna did not show a close relation to the eastern fauna, so also there are no relations between the East Indian Triassic fauna and that of New Caledonia, New Zealand, and Japan, where the Monotis seems to be represented by the genus Pseudomonotis.

That this remarkable connection of the East-Indian archipelago with Europe by the intervention of the Himalaya still continued during the Jurassic period is proved by the discovery of Liassic and Oölitic fossils on the island of Rotti,—as, for example, *Arietites geometricus*, *Harpoceras* cf. *Eserii*, and *Belemnites gerardii*.

It is probable that only after the Jurassic period the East-Indian archipelago came out of direct connection with the European sea, and remained so until now.

THE HAT CREEK BAD LANDS.

BY J. S. KINGSLEY.

A WEEK to spare in the last part of May, railroad transportation available, and the Bad Lands of Nebraska accessible, —who could refuse the trip? The four who made up our party certainly could not. So we started, taking the train for Harrison, Sioux county, aiming to visit the little Bad Lands of the Hat Creek valley, for these were more easily reached than the larger Bad Lands of the White River, and besides they were not as well known or so much explored.

A week's trip is not much to write about, but in a week one can see a good deal, and then in a week the novelty of the strange scenes has not worn off, and the features of the wonderful landscape can be better described. No inhabitant of the West Indies could describe these striking features in such a striking manner as has the late Canon Kingsley. The Bad Lands are often mentioned, but as yet the descriptions of the regions are not numerous.

The journey from Lincoln was without event. First came the climbing out of the valley of Salt Creek, then the long, straight line of track for thirty-five miles, and next the descent into the valley of the Platte at Grand Island. The Platte is a strange stream. Geologically speaking, it is a new river, which has not yet been able to master its sediment. It is broad and shallow, and a deep hole is excavated only to be immediately filled by the shifting sands of the bottom. In dry seasons there are long stretches where no water is visible, but down in the sand the water is still running to the Missouri.

Across the Platte the railroad strikes for the Loup valley, crosses the South Loup, and follows up the fertile fields of Mud Creek. A little beyond Broken Bow the "sand hills" are reached, and through them for two hundred miles we ride. There is nothing picturesque in the landscape now. One can easily imagine himself among the sand dunes of Cape Cod or the New

Jersey shore. Yet these hillocks of shifting sand and scattered tufts of coarse grass are interesting, for in them we find evidence that this portion of Nebraska was not so treeless as it was when the first settlers entered it. As the sand blows it uncovers here and there the well-preserved trunks of pine trees. What could have caused their extinction? Certainly not change of climate, for in the cañons in this same region the same pine grows abundantly.

Beyond Alliance we cross the upper Niobrara, and the landscape again changes, for we have now to cross that long line of hill, Pine Ridge, which extends for over a hundred miles across the northwestern corner of the state. On the southern side there is nothing striking except the pine trees. These have a different habitus from pines in the east. In Maine and in Michigan the pines form dense forests; but here they are scattered like the spruces on a lawn. The train now goes through a tunnel, and we enter the valley of the White River. What a change in the landscape! It is no longer tame, but it is cut and eroded into the most fantastic shapes. To the north is the valley of the river,—here a small stream,—and from it the grassy slopes ascend gradually for several miles; then a more rapid rise, and then the Buttes. Look where you will, you see them. You are among them while far to the north. Clear across the White River you see the same formations. One cannot help thinking that here the process of world-making was suddenly interrupted.

From Crawford to Harrison we follow up the White River. We climb first to the foot of the Buttes; then above them to a broad, level prairie, much like those in the eastern part of the state. Here we find the town of Harrison, 5,000 feet above the sea, where we leave the cars and take a wagon for the Bad Lands.

For three miles north the road gradually ascends, and we strike the head of one of the cañons which are to lead us to the Hat Creek valley. Did I say we were above the Buttes? Even in this highest point we see here and there slight piles of rock, the last remnants of Buttes which once covered this region.

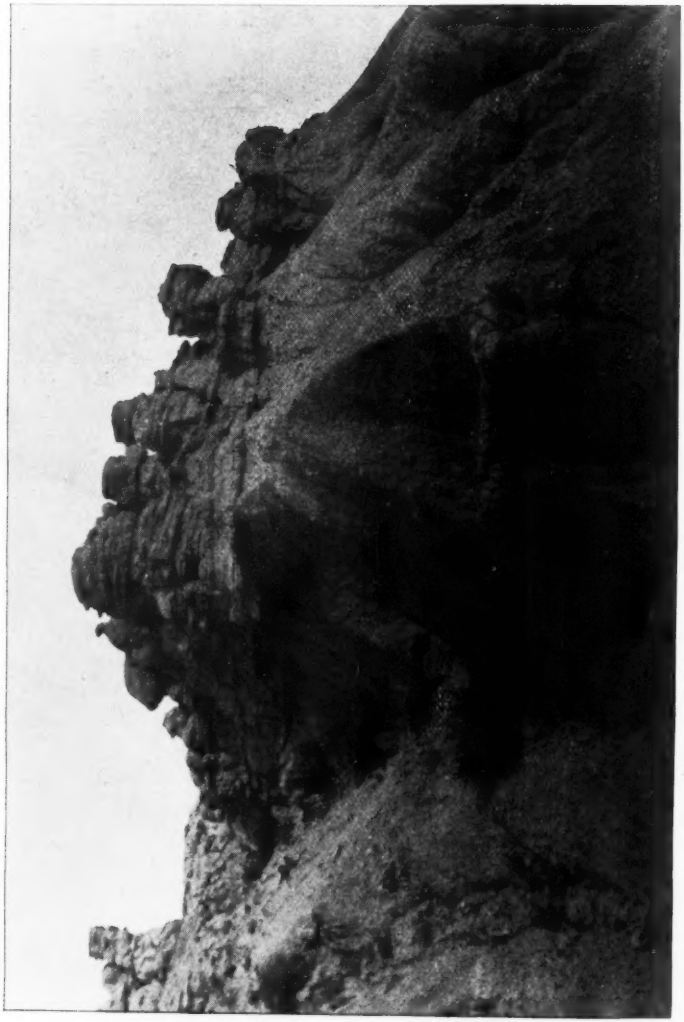
Down the cañon we go, three or four miles, thirteen hundred feet fall. Again we enter the line of Buttes. Those we saw before were the buttresses on the White River side of this divide; those we now see are those of the Hat Creek valley. Follow the horizon around, and everywhere there are the same fantastic forms, extending thirty or forty miles to the north. Away beyond them rise the dark outlines of the Black Hills, and towering above all is Harney's Peak, a hundred and twenty miles away. Halfway down the cañon we followed, came in a side cañon, and here were the most wonderful Buttes of all. In their outlines they reminded us of ruined castles, fortifications, and the like, on a gigantic scale. The lines of stratification of the creamy-white limestone resembled the courses of masonry, while the crevices cut the outline into buttresses, terraces, and embrasures. At the end of the cañon nearest us the resemblance was most striking. The corners were square cut, and the perpendicular walls were between a hundred and fifty and two hundred feet in height. Above them, in the center, towered another mass of rock, fifty feet or more,—just as did the keep in many a mediæval castle.

The broad valley of Hat Creek slopes gradually down from the Buttes, and as we first saw it it looked as if carpeted with grass. A closer glance at the vegetation showed us that here the buffalo grass was not extinct, while the cactuses and sage-bush showed that the land was none of the best. A most striking feature was the number and brightness of the flowers. A little white lily was everywhere, while the bright-colored "loco weeds" (Astragalus and Oxytropis) gave a variety. Throughout all the west these weeds are said to render the animals which feed upon them crazy or "locoed." There is a chance for some investigation here. One of the most striking of the flowers was a little Frittillaria, never before known to occur as far east as Nebraska. It is a graceful lily, with its petals nicely marked with yellow and a purplish brown. At Lincoln fully half the flowers were old acquaintances which I knew in the Atlantic states; but here, four hundred miles from Lincoln, every plant was a novelty. It was interesting to note how closely every plant hugged the earth, the sage-bush and the Spanish bayonet excepted.

As yet no Bad Lands. At last, as we rode along, one of the party, who had been there before, told us not to look up until he spoke. Three minutes passed, and then the signal came. We gazed on the most desolate spot I ever saw. For miles it was all the same. The names Bad Lands, and its French equivalent, Mauvaises Terres, need no defense. Not a bit of green,—nothing but that creamy-white, calcareous, clayey rock; and this was not level and flat, but eroded into the most irregular surface one could imagine. Ridge and gully, ridge and gully succeeding each other for miles,—the summits of the ridge as sharp as the roof of a house, while the gullies in most instances were not wide enough to allow the passage of anything larger than a wheelbarrow. It was a magnificent chance to study erosion; but how was it eroded? The gullies were as dry as the crests of the ridges. Here and there we struck broader gullies, but even here soil was lacking and nothing green was to be seen. The light reflected from the creamy ground was very trying to the eyes, while the heat on a warm day was oppressive. Not a breeze finds its way into these narrow valleys. The walls sometimes rise at the angle of forty-five degrees; at others they are all but perpendicular. They vary from fifty to one hundred and fifty feet in height. The strata of which they are composed are not homogeneous. For the most part they can be easily cut with a knife; but here and there there are harder bands, and this alternation gives rise to strange erosion figures. The lower and softer strata wear away more rapidly than the upper and harder beds, and at one place the result was startlingly like a sitting man with a slouch hat. In places one finds vertical fissures filled with—now gypsum, now calcite.

These Bad Lands are most celebrated for the fossils they contain. In the higher levels of the Buttes fossils are scarce. I am told that they yield but few turtles, and nothing else. In these lower strata of the Bad Lands mammalian remains are abundant, as well as turtles. Some of these latter are small, scarcely three inches in length; some are veritable giants, the carapaces measuring nearly three feet by four. Turtle remains are very abundant. Some are as perfect as when the animal died, while others have

PLATE XX.



BAD LANDS OF HAT CREEK.

succumbed to the frosts and present the collector naught but disarticulated plates. The scarcity of turtle skulls is noticeable; our party collected only a lower jaw, while we found two turtle eggs, one in perfect condition. In one place the turtles presented an interesting phenomenon. They had resisted erosion better than the underlying stone, and as a result in a small area there were about a dozen turtles, each supported on a slender post about two feet above the surrounding surface, while there were as many more which had tumbled down and left the standard to disintegrate.

We had not sufficient time to carefully hunt for fossils and to take only the best, so we did but little digging. It is a tedious process to get a fossil out from its bed. The necessary apparatus consists of a picking hammer, a quantity of tough manilla paper, paste, and patience. When a fossil is found imbedded in the rock, the exposed portions are covered with paper pasted on, and then the paste is allowed to dry. Now more is uncovered with the pick; paper is pasted on again, and so on until the whole is separated from the rock. Excavated in this way the bones are kept in just the relations in which they were found, while the paper protects them from injury in transit. Instead we followed along the gullies searching for the fossils which had been weathered out, and when a portion was found we followed up the wall above it hunting for the rest of the animal. The result of this method of collecting was that we got quantities of fragments; but we also found considerable that was more complete, some of it valuable.

Most abundant of all the mammalian remains were the *Oreodons gracilis* and *major*. These were small animals about the size of a good-sized dog, unlike anything which now exists. Their line is extinct. In some of their features they resembled the pigs, and in others they were more like the ruminants.

Prof. Cope has recently shown their position in the conspectus of the vertebrates which he has published in this journal. He also published a synopsis of the Oreodontidæ in the Proceedings of the American Philosophical Society for 1884, while Prof. Scott, of Princeton, has a valuable and beautifully illustrated paper on them in the *Morphologisches Jahrbuch*, of later date. Other forms which occur more or less abundantly in these beds hardly agree with the fauna of Nebraska to-day. There are

bones which recall the camels and the alpacas; forms which are intermediate between the rats and the squirrels, and others which may be the granddaddies of the horse. Then there were still others which fed on these grass-eating species: tigers with enormous canine teeth, and the still larger Hyænodons with teeth which close together like shears. It was a wonderful fauna which inhabited Nebraska and Dakota in the ages long past.

Will the Bad Lands ever be exhausted of fossils? The treasures of this region and of the larger bad lands of Dakota adorn the museums of the east, and every year collectors are at work. Of course the specimens which are weathered out can soon be picked up, but there are quantities left. In fact, the beds may be said to be inexhaustible. Each spring a new crop may be expected. What has been the history of the region? How did all these animals accumulate here? What makes the land bad? Why is it not like disintegrating rock elsewhere? These are some of the questions. There are few problems in geology which give their answer in a plainer manner. It is a veritable classic and pony.

These regularly stratified beds, layer after layer of marly material, twelve or fifteen hundred feet in thickness, must have been deposited on the bottom of an inland sea, while the character of the fossils—for mollusks occur here and there—shows that the water must have been fresh. To-day these strata are nearly as level as when they were first laid down. The eye cannot detect any departure from the horizontal; and in the Buttes to the north can be traced layer for layer the same beds which occur in the Buttes to the south. There is, however, a slight dip in the strata caused by the upthrust of that strange mountain region, the Black Hills, to the north.

This lake drained the region around, but the geological history of all that region known as the plains shows that then, as now, the streams largely ran from west to east. Hence the principal affluents of this Miocene lake must have come from the west. The climate then was probably different from that to-day, for nowhere within two hundred miles is there rainfall sufficient to maintain such a lake as this.

On the shores of this lake and on the banks of the tributary streams lived those animals which supplied the fossils of to-day.

First and most abundant were the Oreodons and their allies. The number of their remains shows that they most probably formed large herds. Rarer were the horse-like forms, which, however, resembled but little the horses of to-day. Then there were camels and rhinoceroses, and largest of all the immense Menodus, the lower jaw of which measured about two feet in length. These animals fed on the vegetation, while the cats and Hyænodons of the time preyed on these. How the bodies were transferred to the place where we find the bones is a problem easily solved. Probably there were freshets caused by abundant rains, and numbers of animals were swept by the stream into the lake. Here the bodies floated about, disturbed by the gases of decomposition, until a part dropped here and another there. This explains the scattered condition of the bones to-day. Even in the solid rock it is unusual to find more than two or three bones together. Certain it is that these animals were not mixed where we find them.

At length the conditions changed. The lake still remained, gathering sediment at the bottom, but the mammalian remains are much scarcer than before, and even in the upper portions of these bad-land strata they are much less abundant than in the lower beds. What was the cause? I do not know. Still the lake continued laying down stratum after stratum until there was at least more than a thousand feet of rock piled upon the top of the fossils. How much more there was we do not know. The Buttes are our sole register in this respect. We no not know how much erosion there has been from their tops.

At last the lake became dry, and its old bottom was exposed to the air, and now erosion began. Looking across the Bad Lands from the tops of the Buttes, and seeing that valley forty or fifty miles across, and with an average depth of eight hundred or a thousand feet, one no longer wonders at the muddy Missouri or at the immense alluvial deposits which the Mississippi has made; and yet this same erosion is going on and has been going on at a thousand other places of equal extent.

Rapid erosion now ceased, and the broad valley with its gently undulating surface gained a soil. Then a second erosion began, and it is this second erosion which has produced the Bad Lands.

Here and there in this area we find a bit of what might be termed tableland or a small scale. The upper surface is covered with a scanty vegetation of buffalo grass, cacti, sage-brush, and *Agave angustifolia*, with the ever-present loco weeds. But the slopes of the tableland are abrupt, and not a bit of green can be found on them. The geological history of the region can be predicted. This erosion will go on until the ridges are all worn away, and the bad lands again become reduced to a plain. Then as Hat Creek wears a deeper channel, erosion will again be increased, and the Bad Lands will be repeated.

At first sight we all thought that the erosion was extremely rapid. The rock looks at first sight as if it would melt like sugar when it rained, but apparently this is not the case. My conclusions are that the winter frosts are the really efficient agents in the process. Rain and melting snow penetrate for an inch or two into the rock, and then the expansion of the freezing water disintegrates the outer surface of the rock, and it is only this outer portion which is soft. We found a place where for two years an irrigating ditch had emptied itself into the Bad Lands. It had nearly washed away this outer softened layer. The solid rock showed no signs of wear.

In studying erosion in this region one must remember that here the rainfall is not excessive. Some ten or fifteen years ago Prof. Samuel Aughey published some charts and tables, the object of which was to show that the rainfall was increasing rapidly in Nebraska. The lines on his maps were as firmly drawn as the contour lines in a topographical survey. But alas! there is no evidence, nor has there ever been, to support these charts and these conclusions drawn from them. The annual rainfall is given or regions and times when there were no observations and no one there to observe. To-day our statistics are scanty, and now reach back far enough to enable us to say whether the annual rainfall is increasing at all. Apparently from the slight data we have in the Bad Land region a rainfall of sixteen inches in a year is unusual. With that slight amount extensive erosion is not probable.

The question is asked, Will these Bad Lands ever be of value? Not in the immediate future. A country so extremely irregular is not available for agriculture. A few years ago this whole

region was occupied by cattle rangers, and thousands of heads were to be found here. Here and there, flowing down from the cañons, are small streams which afforded water, while in the dry climate the grass cures on the ground and, is available for pasturage the whole year round. Rarely are the snows sufficiently deep to prevent the animals feeding in the open field. A few years ago the region was preëmpted by settlers. The cattle were driven out, and to-day the barb-wire fence shows the limits of the farms. But these farmers have a sorry time of it. No rain, no crops. I should not be surprised to see the whole country go back to grazing.

Owing to various circumstances we had but twelve hours' actual collecting time; and we went over but a corner, some six miles across, of the Bad Lands. Not much could be expected in so short a time and in such hurried and superficial collecting, yet when we got back to the railroad and packed our fossils we found that all four had obtained over 450 pounds. A list of the species we obtained would prove dry, but a rapid examination of the fossils showed some thirty or forty species represented by fragments or more complete remains.

Of animals we found comparatively few traces. The region is not such as to support an extensive fauna. We were told that mountain lions, timber wolves, and coyotes were comparatively common. In the Bad Lands and in the country surrounding we found several skulls and a good many horns of the buffalo. Horned toads are comparatively common in the whole region. The cacti form a habitation for a true cochineal insect; but to me the most surprising find was a scorpion in the Bad Lands. I did not suppose that they occurred nearer than Southern Kansas and Colorado, three or four hundred miles nearer the equator.

One of our party was an entomologist, and he obtained numerous good things on the trip. One evening, as we were making up our beds in the open air, we were completely covered by a small June bug. The entomologist told us that the species was described but a few years before from specimens which he collected. Scarcely half a dozen specimens represented the species in all the collections of the world. He took hundreds of specimens away with him.

ON THE QUANTITY AND DYNAMICS OF ANIMAL TISSUES.

BY J. LAWTON WILLIAMS.

EVERY ONE knows that the animal tissues are not fixed and unvarying quantities. From the time of an animal's first appearance in the outer world to that of its disappearance by the natural processes of dissolution it exhibits many morphological changes, so obtrusive as not to require comment. They are spoken of as developmental changes, and are often so radical and thoroughgoing that the later forms in the series bear no resemblance to their antecedent forms. Such are the total metamorphoses of certain insects, crustaceans, worms, and sponges. Partial metamorphoses are gone through even by the highest types, so that the adult form often possesses morphological characteristics which are not present in the young, or *vice versa.* But there are other less obvious changes which affect the tissues, and are not so easily studied by direct observation. Such are the changes in quantity arising from varying rates of nutrition and other disturbing causes. Besides these fluctuations, which are directly referable to immediate causes, there are others which appear to be constitutional, and proceed along definite paths of development throughout the lifetime of the animal. Moreover, these less apparent changes seem to adhere to animal species with much the same persistency that the more ostensible outward differences do. That is to say, just as one can distinguish an adult deer from its young by change in the form of its antlers, so, if he were a thorough expert, he could detect equally important changes in its internal parts which might serve as the basis of distinctions just as important as the ones here employed. In the absence of any extended investigations, it is impossible to speak with quantitative exactness of the inner changes from the time of birth to the attainment of old age. Such a record upon any one animal would be impossible from the very fact that the first investigation would deprive the animal of life. To conduct intelligent experiments

on different representatives of the same species would require a knowledge of the age, food, and environments of the different animals dissected, and then we would have to proceed upon a supposition, probably never realized in nature, that all the subjects of the experiment varied together in the quantity and distribution of all their tissues. Obviously such a supposition would be purely artificial; and to insure all the conditions for the faithful execution of the experiment would require precautions so labored and extraordinary as to baffle the most skillful experimenter.

But while it is impossible to obtain exact and absolutely reliable data which may serve as the basis of laws of specific development, yet there are certain general and approximate methods which may lead to very much the same end. Such data may be derived in part by observations of the outward contour as determined by the plumpness or leanness of the animal. It is true that inferences based upon such observations may often be misleading, owing to our ignorance as to just what tissues produce the fullness or shrinkage in any given instance, and as to whether the same amount of shrinkage at different times is caused by the degeneration of the same or different tissues. Many valuable suggestions may be gleaned, however, from post-mortem examinations of typical cases. Such examinations, if found to be often confirmatory of previous conjectures, will tend to inspire confidence in our methods and results. There can be nothing more certain than that most mammals are subject to easily observable changes in their external contour from the time of their birth onward. Puppies and kittens, for example, are clumsy and thick-set when born, the latter being positively corpulent. As growth proceeds, however, the legs and body elongate, and the relative proportions of limbs and body are altered in a marked manner, the body becoming often quite lank. Quite the reverse happens to the calf and colt. They are very gaunt and long-legged, to begin with; but grown cows and horses become decidedly thick and sometimes unwieldy. The muscles also change in form and relative dimensions. Changes like these are points of common remark in the human subject. Plump babyhood and childhood, spare youth, stout manhood, and weazen old age have all found place in familiar

proverb and song. All these outward changes are certainly expressions of inner changes equally important and significant.

In early life the vegetative functions preponderate. Eating and attendant growth are the all-important activities. But bye and bye the animal functions of motion come into play. Nutrition then ceases to be the dominant function, and the surfeited tissues give up their useless store to the growing demands of higher activities. The result is a redistribution to suit the specific needs of the animal organization in question. This redistribution does not cease until a new equilibrium is established which harmonizes with the existing orders of activity. Then a stage of equilibrium ensues, which may be called the balance of middle life. It continues until the already abridged functions of nutrition begin to yield further ground, weakened by the approaching exhaustion of an ebbing and dwindling vitality. This waning of the nutritive functions is manifested by a loss of flesh, and the angular, bony framework projects out through the wasted habiliments of muscular and adipose tissue. At last the vital store is exhausted, the nutritive processes cease, and the animal dies. Such, in brief, is the story of the average mammal's life, though the details are often disguised in various ways. While we cannot exactly formulate the variations of tissue at different periods, yet an average of many weighings will not lead us much astray. Such averages of different species closely allied may be compared with profit.

We are all more or less familiar with certain differences of absolute and relative weight and volume in the homologous tissues of different species. Results of this sort, especially on the brains of animals, are quite frequently met with. In all such cases, however, we are often perplexed to know, especially in animals with only remote systematic affinities, just how far it is legitimate to compare apparently homologous organs, and where such comparisons should end. For this reason it is generally well to restrict our comparison to animals of the same subkingdom, and, better still, of the same class, for the greater the divergence of remotely analogous tissues the less reliance can be placed on the comparative results. There are other difficulties which arise in the study of the quantities of tissue in the same animal. In

highly organized animals the differentiation of parts is often carried to such extremes, and the histological and anatomical lines of division are so ill defined, that we cannot say precisely where one tissue begins and another ends, and even the distinctions of a tissue as the material endowed with specific physiological functions is necessarily arbitrary and includes heterogeneous elements. To illustrate, it is not uncommon to find tables of the comparative weight of vertebrate brains. The value of such tables from the standpoint of strict homology is not very great. How utterly impossible it would be to find strictly homologous parts in all the cerebral tissues even in the different members of the class Mammalia! Certainly the range of physiological and psychological functions which these tissues discharge in the different members of the class is a very wide one. Some of them are unique and peculiar to one order, and are not represented in the others. Considerations like these bring us to realize that all quantitative studies of the tissues must necessarily proceed upon arbitrary assumption as to what parts are proper subjects of comparison. Probably, after all, the best method of pursuing such studies is to compare tissues with approximately the same physiological functions. This method I have pursued in the case of a few of the higher animals. The weight of the skins, skeleton, muscles, bones, and viscera were made the subjects of comparison. Under the last division were included not only the viscera proper, but also the lungs, brain, and all parts not properly falling under the other divisions. Under the head of skeletal muscles, tendons and ligaments were necessarily included; and under the head of the bones, cartilages and fatty marrows were included. Only a few dissections were made, and hence all inferences based upon them are necessarily incomplete, and require to be stated with extreme caution. The following comparative table gives the results:

Animals.	Skins.	Bodies.	Ratios of Skin to Body (approximate).
Woodchuck,	12 oz.	80 oz.	1 : 7
Rabbit,	3 oz.	23 oz.	1 : 8
Gray squirrel	5 oz.	25 oz.	1 : 5
Black squirrel,	4 oz.	24 oz.	1 : 6
Skunk,	13 oz.	3 lbs. 10 oz.	1 : 4½

Animals.	Muscles.	Bodies.	Ratios of Muscles to Body (approximate).
Woodchuck,	1 lb. 4 oz.	5 lbs.	1 : 4
Rabbit,	10 oz.	23 oz.	1 : 2
Gray squirrel,	12 oz.	25 oz.	1 : 2
Black squirrel,	11 oz.	24 oz.	1 : 2
Skunk,	13 oz.	3 lbs. 10 oz.	1 : 4½

Animals.	Bones.	Bodies.	Ratios of Bones to Body (approximate).
Woodchuck,	1 lb.	5 lbs.	1 : 5
Rabbit,	5 oz.	23 oz.	1 : 4½
Gray squirrel,	4 oz.	25 oz.	1 : 6
Black squirrel,	4 oz.	24 oz.	1 : 6
Skunk,	11 oz.	3 lbs. 10 oz.	1 : 5

Animals.	Viscera.	Bodies.	Ratios of Viscera to Body (approximate).
Woodchuck,	1 lb. 12 oz.	5 lbs.	1 : 3
Rabbit,	5 oz.	23 oz.	1 : 4½
Gray squirrel,	4 oz.	25 oz.	1 : 6
Black squirrel,	5 oz.	24 oz.	1 : 5
Skunk,	14 oz.	3 lbs. 10 oz.	1 : 4

The fact which impresses us most about these figures is that the relative proportions of the tissues here considered are far from constant in the same and in different animals. The right-hand figures in the column of ratios are well calculated to emphasize this fact. The tegumentary, bony, nutrient, and motor tissues do not each have equal weights in the same animal, and the ratio of their weights to the body-weights are not the same in different animals. For example, the ratio of the weights of the skin to the body vary all the way from 1 : 8 in the rabbit to 1 : 4½ in the skunk; the ratios of the muscles from 1 : 2 in the rabbit and squirrels to 1 : 4½ in the skunk; the ratios of bones from 1 : 4½ in the rabbit to 1 : 6 in the squirrels; and the ratios of the viscera from 1 : 3 in the woodchuck to 1 : 6 in the gray squirrel. Thus it appears that variations of one-half are not uncommon for the same tissue in different animals, and much profounder differences exist in the weights of different tissues of the same animal. Without doubt, more extensive dissections would reveal even greater extremes in the quantities of tissue in other mammals and in vertebrates generally. Certainly the nerves and the brain exhibit

immense quantitative differences in animals of different species. While the brain of the elephant, the largest of terrestrial mammals, has the greatest absolute weight, and that of the whale, the largest of all mammals, the next in size, yet among the smaller animals it is well known that the brain of man is preëminent in size. The brains of fishes and reptiles are exceedingly small in proportion to the size of the body, and the brain of Coryphodon, the prototype of the Ungulata, from the early Tertiary, was relatively much less than the average existing mammalian brain. The several tissues differ immensely in the range of their quantitative variations. Some of them, as the bones and muscles, grow under mutual limitations prescribed by the mechanical conditions of animal movement. If the animal is to move it must have motor tissues, and it must have hard parts upon which the motor tissues can act. The existence of the one necessitates the existence of the other, and that in certain quantity as well. The quantity of the one is reactionary upon the quantity of the other. If one is destroyed the other no longer has any use, and eventually suffers degeneration. Like relations subsist between certain correlated organs of the viscera. They act and react upon one another, and hence their growth and decline must go on together. There are other tissues the growth of which is mutually antagonistic. Darwin and Cope have cited the examples of the Artiodactyla where the evolution of the antlers is accompanied by a disappearance of some of the teeth. Facts of like import are not wanting in the case of the other tissues. Cope explains them by assuming that the animal has a fixed complement of vitality or bathmic force, and hence, by the principle of the conservation of energy, an expenditure in one form of growth must be compensated for by an equivalent suppression of some other form of growth. Cephalization is really a special case of this general principle, where the lines of maximum growth converge in a common direction. The acceleration of parts headward is coincident with the abortion of parts tailward. Under this view it is easy to suppose that the disappearance of the tail in man was accomplished by an enlargement of his cranial capacity, and the vital energy that was expended in its movement has now been trans-

formed into some higher psychical energy. Finally, there are some other tissues, the quantity of which does not seem to be subject to the limitative adjustments of other tissues, because they are not directly concerned in the vital economy, and they fluctuate very perceptibly with the changing conditions of the animal's environment. Such is the adipose tissue. Cells of fat may increase independently of any mechanical laws prescribed by other tissues (of course within limits compatible with life), as in the omentum of corpulent people and the layers of adipose tissue in swine. We thus see that there are quite well-defined types of growth among the tissues of animals. There are those which increase and decrease together, those which increase at the expense of others, and those which vary independently. Of course these lines are not absolutely distinct, and probably every tissue in some degree embodies them all. This classification is given as having a general value only; but while there are specific and individual variations which have no apparent connection with any general evolutionary principles, there are variations, extending over longer periods of time, which have a historical value to the anatomist and paleontologist. They are the larger cycles of change in which these individual cycles move and exist. In the brief period of a human lifetime they are disguised by the seemingly irrelevant fluctations of the present, and it is only in the light of a remoter history that we gain a full conspectus of the progress of these events.

All through the Paleozoic and Mesozoic ages there was a remarkable profusion of molluscan and radiate life. Lime-secreting animals were the prevailing type in all seas, and the seas were everywhere. In many places the rocks are almost entirely composed of the remains of these animals. Finally fishes made their appearance. They continued to develop, and have reached their highest phase of specialization at the present time. Then the reptiles came, and at length the mammals. This succession has been marked by a concomitant succession in the relative quantities of animal tissues. When the primeval seas were surcharged with carbonate of lime the organisms then living rapidly used up the excess in secreting protective coverings for their softer parts. In some of the early

Brachiopoda, as Discina and Productus, a calcareous shell made up a large part of their weight. The rugose and tabulate corals, the Cephalopods, and many other forms were permeated through and through with walls and tables of calcareous masonry. This process continued for a long succession of ages. Even when the early fishes appeared they too were plated and shielded by thick secretions of carbonate of lime. But as the type of fishes expanded a new tendency became developed, which has continued to manifest itself ever since. Even the early Ganoids possessed a much greater quantity of soft tissue in proportion to the hard parts than did the Brachiopods and corals. This, of course, was an indispensable prerequisite to the free and roving life which they led. Had they been weighted as heavily as some of the Brachiopods, locomotion would have been out of the question; in fact, it may be enunciated as a general principle that wherever an animal is found capable of vigorous and long-continued locomotion, there we may be sure to find the motile elements of the body sustaining a high ratio to the inert elements. But later on forms like the Cestracionts and other sharks must have had a very large excess of soft parts over hard parts. Later still the heavy ganoid scales were discarded for the lighter ones of the Teleosts. The secretions of lime became less, and the excess of hard parts over soft parts was diminished until the opposite relation existed. While this tendency may not be traceable in all cases, yet there are a sufficient number of instances to warrant the generalization that the development of animal life has been marked by a growing diminution in the quantity of hard parts, and a relative increase in the quantity of soft parts. The gigantic reptiles of the Cretaceous age and mammalian life of later times all point to this conclusion. The change in the relative quantities of hard and soft parts was attended by other correlated changes. As the soft parts were liberated from the incubus of the hard parts they gradually differentiated in various directions, to suit the altered conditions of their environment. By reducing its calcareous integument the animal was more exposed to the attacks of its enemies; and this exposure necessitated one of two things,—either it must take on protective colors or spines, or it must differentiate

motor tissues and organs by which to escape those enemies. In some cases both lines of development have been pursued in some part by the same animal. The locomotive function must certainly have played a highly important part in the life of fishes from the very first, and in birds its manifestations are even more intense. But with the evolution of locomotive powers there arose a need of a system of external or internal leverage, and the result of that necessity is the exoskeleton and endoskeleton of the Arthropoda and Vertebrata respectively. A nutritive apparatus necessarily coëxisted with the lime-secreting activity. But when the factor of locomotion became added to the animal life new differentiations of structure were called into being. Function and tissue reacted again and again in endless combinations, and the present diversities of organic structure were the result. That result was marked not only by qualitative but quantitative peculiarities, and it is these peculiarities that we have been discussing. Such, in brief, is the historical outline.

We now pass on to consider the dynamics of the subject. It is a patent fact that a division of labor is beneficial to all the laboring elements. It is no less true that it results in some degree of dependence between those elements. The degree of the dependence is heightened the farther the specialization is carried. This is eminently true of the animal organism. In its simplest expressions as *Protamœba* an absolute independence between the parts everywhere prevails. All parts alike respond to all stimuli, and no part is anything in particular, but everything in general. In higher forms the structures are more diversified, and they assert their individuality by differential responses to external stimuli. Moreover, each member gives a complete response only when it sustains a connection with all its fellow-members. The several members form a joint society, whose union is strength and whose dissolution is ruin. Such is the polity of the animal body. Now we have seen that the several tissues vary in quantity. They vary in the same individual at different periods of life, and in individuals of equal age in the same and in different species. Such variations in the tissues must profoundly affect the amount of functional activity. Suppose we

compare two of the animals given in the tables, the woodchuck and the rabbit. The ratios of the weight of muscle to the weight of body in the two animals stand in the proportion of 1 : 2. That is to say, the rabbit has two pounds of muscle for every one possessed by the woodchuck, which it can use in moving its body. Now the specific energy of striped muscle in animals as widely separated as the bird and man stand only in the insignificant ratio of 1200 : 1087 ("Animal Mechanism," E. J. Marey), so that we do not feel that we are assuming too great impossibilities when we call the specific muscular energies of the woodchuck and rabbit equal. Now this equality can only subsist for a period of extended duration on condition of equal metabolic activities in the two tissues. These activities, in turn, will depend on the food supply, digestion, and all the preliminary acts of nutrition. But to avoid complications we will adhere to our first assumption. Now the woodchuck has to move twice the inert mass in proportion to its muscular weight as the rabbit. To do this it can execute only one-half the quantity of motion as the rabbit. Then the rabbit leads a life twice as active as the woodchuck. But the viscera of the woodchuck are to those of the rabbit nearly as 3 : 2, and assuming equal nutritive powers in equal weights of the viscera, the difference of muscle weight would be partially offset by a canceling difference in the rates of repair of the wasting tissues. This assumption, however, that equal quantities of viscera repair equal amounts of waste, is not a safe one. Besides, it will be remembered that in these experiments organs as widely diverse in function as the brain, lungs, liver, and heart were, to avoid confusing details, weighed together and classed as viscera.

The rate of assimilation and repair of the muscles would clearly depend upon the size and activity per unit quantity of the organs concerned in the vegetative functions. Organs of different function, as the brain (which is extremely variable in size), would vitiate the comparison between equal quantities of viscera as here employed. But, what is still more adverse to the assumption, there is no good reason for supposing that equal quantities of organs discharging the same functions create equal functional products. Butchers say that in old cows the intestines have a

much greater size in proportion to the body than in young cows and heifers. They are also poorer, and it requires a much greater amount of food to produce a given amount of flesh than in younger animals. This case seems to indicate that the efficiency of the organ degenerates with increasing size. Of course this is not always true, and there are marked instances to the contrary, as in the relatively large brains of certain intellectual prodigies and the heavy biceps of professional pugilists. Probably the differences of size in the functional organs of the viscera are, in many cases, due to the growth of indifferent tissues as fat and connective fibers. Perhaps their presence in the case of the cows already mentioned may even impede the normal discharge of the functions. Be this as it may, it is undeniable that the greater quantities of viscera are by so much an added incubus to the movements of the animal. It is, of course, self-evident that in most cases all the tissues not directly concerned in the contractions which produce motion are in some degree adversative to such contractions. Only a few of the voluntary muscles are used in any one movement, and all the rest of the body is, for the time being, a dead weight to be overcome; so that in the simplest of our daily movements the active and passive parts are continually shifting about, and the waves of maximum activity travel now here and now there. All the tissues, save the voluntary muscles, are perpetually inert relative to movements in the environment. They are at one time impelled to passive movements, and at another time are quiescent, according to the character of the movement. They are in one sense a necessary evil, impeding and yet indirectly promoting the movements of the animal.

Lastly, we have to consider the bones. Without doubt they are inert elements. Yet that very inertness serves a useful purpose in the animal movements. If we compare the ratios of the bones to the body and of the muscles to the body in the woodchuck and rabbit, we are surprised at the absence of parallelism which a knowledge of their mutual connection would lead us to expect. While the muscles of the woodchuck are to those of the rabbit relative to the body as 1 : 2, the bones are nearly equal in the same comparison. This is explained by the fact that the total

weight of body to be supported is greater in the woodchuck, and since the quantity of muscle is relatively smaller, the animal is forced to a sedentary life and does not move about much. Even the forms of body in the two animals harmonize with this view. The woodchuck is stout and heavy, the rabbit is agile and slender. Just as the heavy bones of the woodchuck are indicative of its sluggish habits, so the light bones of the rabbit point to an opposite inference. Very much more could be said of the quantities and dynamical values of the animal tissues, but this must suffice at present. It is hoped that further evidence will be brought forward on some of the points here barely alluded to. The subject is certainly a very fruitful one for future research.

RECORD OF AMERICAN ZOOLOGY.

BY J. S. KINGSLEY.

(Continued from Vol. XXV., page 716.)

GENERAL.

OSBORN, H.—Local problems in science. Proc. Iowa Acad. Sci. for 1888, p. 19, 1890.—Résumé of work done on natural history of Iowa.

COPE, E. D.—Lamarck vs. Weismann. *Nature*, XLI., p. 79, 1889.

* MCNIELL, J.—The male element the originating factor in the development of species. *Psyche*, V., p. 269, 1889.

RYDER, J. A.—Proofs of the effects of habitual use in the modification of animal organisms. Proc. Am. Phil. Soc., XXVI., p. 541, 1889.

KIRSCH, A. M.—Cytology or cellular biology. *Microscope*, X., p. 360, 1890.—Statement of Carnoy's work.

GULICK, J. T.—Divergent evolution and the Darwinian theory. *Am. Jour. Sci.*, XXXIX., p. 21, 1890.

RYDER, J. A.—An attempt to illustrate some of the primary laws of mechanical evolution. Proc. A. N. S. Phila., 1891, p. 62.

ORCUTT, C. R.—A marine labratory. *West Am. Scientist*, VII., p. 59, 1890.—Suitable localities near San Diego, Cal.

STEARNS, R. E. C.—On accidentally introduced forms of animals. *West Am. Scientist*, VII., p. 107, 1891.

JEFFRIES, J. A.—Lamarckism and Darwinism. Proc. Bost. Soc. N. H., XXV., p. 42, 1890.

RYDER, J. A.—The origin of sex through cumulative integration, and the relation of sexuality to the genesis of species. Proc. Am. Phil. Soc., XXVIII., p. 109, 1890.

LEIDY, J.—Remarks on the nature of organic species. Trans. Wagner Free Inst., II., 1889.

PROTOZOA.

STOKES, A. C.—Notices of new fresh-water Infusoria. Proc. Am. Phil. Soc., XXVIII., p. 74, 1890.—18 new sp. New genera are: Macromastix, Furcilla (preoc.), Homalozoon. As usual, no localities are given.

ATWELL, C. B.—Procuring amœba for the laboratory. *Am. Mo. Micros. Jour.*, XI., p. 264, 1890.

RYDER, J. A.—On two new and undescribed methods of contractility manifested by filaments of protoplasm. Proc. A. N. S. Phila., 1891, p. 10.—*Vide* AM. NAT., XXIV., p.

SPONGES.

POTTS, E.—Fresh-water sponges. V. The determination of the species. *Microscope*, X., p. 307, 1890.

LEIDY, J.—Note on the boring sponge of the oyster. Proc. A. N. S. Phila., 1891, p. 122.

POTTS, E.—Report on some fresh water sponges collected in Florida. Trans. Wagner Free Inst., II., p. 5, 1889.—N. sp., *Spongilla wagneri.*

CŒLENTERATA.

BROOKS, W. K., and CONKLIN, E. G.—On the structure and development of the gonophores of a certain siphonophore belonging to the order Auronectæ Haeckel. J. H. U. Circ., X., p. 87, 1891.—See AM. NAT., XXV., p.

BIGELOW, R. P.—Notes on the physiology of *Caravella maxima* Haeckel (*Physalia caravella* Eschscholz). J. H. U. Circ., X., p. 90, 1891.

AGASSIZ, A.—On the rate of growth of corals. Bull. Mus. Comp. Zool., XX., No. 2, 1890.

FORBES, S. A.—On an American earthworm of the family Phreoryctidæ. Bull. Ill. Lab. N. H., III., p. 107, 1890.—*Phreoryctes emmissarius.*

LEIDY, J.—Beroe on the New Jersey coast. Proc. Phila. Acad., 1890, p. 341.

——Remarks on Velella. Proc. Phila. Acad., 1890, p. 408.

HEILPRIN, A.—The corals and coral reefs of the western waters of the Gulf of Mexico. Proc. A. N. S. Phila., 1890, p. 303.

FEWKES, J. W.—A new instance of parasitic hydroids. *Microscope*, X., p. 329, 1890.—Sertularia on Hemitripterus.

HEILPRIN, A.—Rate of coral growth. Proc. A. N. S. Phila., 1891, p. 75.

ECHINODERMATA.

BROOKS, W. K.—On the early stages of Echinoderms. J. H. U. Circ.; X., p. 101, 1891.

FIELD, G. W.—Contributions to the embryology of *Asterias vulgaris*. J. H. U. Circ., X., p. 101, 1891.

IVES, J. E.—Echinoderms from the northern coast of Yucatan and the harbor of Vera Cruz. Proc. A. N. S. Phila., 1890, p 317.—*H. silamensis* and *H. nitida* are new; new genus, Thyraster for *Echinaster serpentarius;* notes on other forms.

PLATHELMINTHES.

BRANDEGEE, K.—Cœnurus of the hare. *Zoe*, I., p. 265, 1890.

LEIDY, J.—Notices of Entozoa. Proc. Phila. Acad., 1890, p. 410.—Describes as new *Distomum trapezium* (from Osprey), *D. aniarum* (from *Tropidonotus sipedon*), *D. gastrocolum* (from *Trichiurus lepturus*), *D. ischium* (from *Saurus fœtens*), *D. lasium* (from *Ilyanassa obsoleta*), *Cercana platyura* (Wyoming), *Tænia nematosoma* (from *Esox reticulatus*), *Phyllobothrium inchoatum* (from *Mesoplodon sowerbiensis*).

——Parasites of *Mola rotunda*. Proc. A. N. S. Phila., 1890, p. 281.—*Distomum pedocotyli* nov., *Anthocephalus elongatus*.

SHARP, B.—On a probable new species of Bipalium. Proc. A. N. S. Phila., 1891, p. 120.—*B. manubriatum* (greenhouse in Penna.).

WOODWORTH, W. M.—Contributions to the morphology of the Tubellaria. I. On the structure of *Phagocata gracilis* Leidy. Bull. Mus. Comp. Zool., XXI., No. 1, 1891.

NEMATOIDA.

MARK, E. L.—Trichinæ in swine. 20th Rep. Mass. Board of Health, p. 113, 1888 [1890].

CALVIN, S.—Notes on Trichina. Bull. Lab. Nat. Hist., Univ. Iowa, II., p. 85, 1890.

LEIDY, J.—Notices of Entozoa. Proc. Phila. Acad., 1890, p. 410.—New forms are: (?) *Filaria primaria* (from Orang), *Ascaris diacis* (purple grackle), *Atractis* (Ascaris) *opeatura* (from *Cyclura bæolopha*), *Trichosomum* (?) *tenuissimum* (brown rat).

ACANTHOCEPHALI.

LEIDY, J.—Notices of Entozoa. Proc. Phila. Acad., 1890.—Describes (p. 413) as new, *Echinorhynchus paucihamatus* (from black bass).

ANNELIDA.

IVES, J. E.—On *Arenicola cristata* and its allies. Proc. A. N. S. Phila., 1890, p. 73.

ANDREWS, E. A.—A commensal annelid. AM. NAT., XXV., p. 25, 1891.—*Polydora commensalis.*

——The distribution of Magelona. J. H. U. Circ., X., p. 96, 1891.—See AM. NAT.

RANDOLPH, H.—The regeneration of the tail in Lumbriculus. *Zool. Anz.*, XIV., p. 154, 1891.—See AM. NAT.

PROSOPYGII.

ANDREWS, E. B.—A new Phoronis. *Ann. and Mag. Nat. Hist.*, June, 1890. *Vide* NAT., XXIV., p. 1083.

DALL, W. H.—Notes on some recent Brachiopods. Proc. A. N. S. Phila., 1891, p. 172.

DAVENPORT, C. B.—Cristatella: the origin and development of the individual in the colony. Bull. Mus. Comp. Zool., XX., 1890.

——Preliminary notice on budding in Bryozoa. Proc. Am. Acad. Arts and Sci., XXV., p. 278, 1891.—See AM. NAT.

ANDREWS, E. A.—Notes on the anatomy of *Sipunculus gouldii* Pourlatès. Studies Biol. Lab. J. Hopkins Univ., IV., p. 389, 1890.

MOLLUSCA.

CONKLIN, E. G.—Preliminary note on the embryology of *Crepidula fornicata* and *Urosalpinx cinerea*. J. H. U. Circ., X., p. 89, 1891.

WATASE, S.—Studies on Cephalopods. I. Cleavage of the ovum. *Journ. Morp.*, IV., p. 247, 1891.

STEARNS, R. E. C.—On the distribution of *Planorbis bicarinatus*. *West Am. Scientist*, VI., p. 110, 1889.

PILSBRY, H. A.—New and little-known American molluscs, No. III. Proc. A. N. S. Phila., 1890, p. 296.—*Vide* AM. NAT., XXIV., pp. 354, 814. New forms are: *Pupa syngenes* (Ariz.) *Zonites shimeki* (Iowa), *Vaginulus schirelyæ* (Bermuda), *Goniobasis crandallii* (Ark.).

YATES, L. G.—The Mollusca of Santa Barbara county, California. Bull. Sta. Barbara Soc. Nat. Hist., I., p. 37, 1890.—Nominal list.

——New shells from the Santa Barbara channel. Bull. Santa. Barbara Soc. Nat. Hist., I., p. 46, 1890.—New species are: *Venus fordii, Vertagus lordii, Vermiculus fewkesi.*

COCKERELL, T. D. A.—The Virginia colony of *Helix nemoralis*. *Nautilus*, III., p. 73, 1889.

BAKER, F. C.—Description of a new species of Ocinebra. *Nautilus*, III., p. 80, 1889.—*O. jenksii;* hab. unknown.

STEARNS, R. E. C.—*Helix* (*Stenotrema*) *hirsuta* Say, on the West Coast. *Nautilus*, III., p. 81, 1889.

CARPENTER, H. F.—The shell-bearing Mollusca of Rhode Island. *Nautilus*, III., p. 82, 1889.—Continued.

PILSBRY, H. A.—Note on a southern Pupa. Proc. A. N. S. Phila., 1890, p. 44.—*P. hordeacella* (Tex., Ariz., Fla.).

BAKER, F. C.—Remarks on *Urosalpinx perrugatus*. Proc. A. N. S. Phila., 1890, p. 46.

PILSBRY, H. A.—On a new Bulimulus. Proc. A. N. S. Phila., 1890, p. 63.—*B. ragsdalei* (Tex.).

BAKER, F. C.—On the modifications of the apex in Murex. Proc. A. N. S. Phila., 1890, p. 66.

SHARP, B.—Variations in *Bulimus exilis*. Proc. A. N. S. Phila., 1890, p. 148,

PILSBRY, H. A.—On *Helix albolabris*, var. *maritima*. Proc. A. N. S. Phila., 1890, p. 282.

JACKSON, R. T.—Studies of Pelecypoda. AM. NAT., XXIV., p. 1132, 1890 [1891].

——The mechanical origin of structure in Pelecypods. AM. NAT., XXV., p. 11, 1891.

VAN INGEN, G.—Preliminary list of the land snails of Poughkeepsie, N. Y. Trans. Vassar Bros.' Inst., V., p. 161, 1890.

BAKER, F. C.—Remarks on the Muricidæ, with descriptions of new species of shells. Proc. A. N. S. Phila., 1891, p. 56.—*Ricinula* (*Sistrum*) *rugosoplicata* (lower Cal.) is the only new American species.

——Notes on a collection of shells from Southern Mexico; *l. c.*, p. 45.—Nominal list.

YATES, L. G.—A new locality for *Helix ayresiana*. *West Am. Scientist*, VII., p. 8, 1890.—Islands off California coast.

* DALL, W. H.—Results of dredging in the Gulf of Mexico and the Caribbean Sea, [etc.].—Report on the Mollusca. Pt. II. Gastropoda and Scaphopoda. Bull M. C. Z., XVIII.—Describes 385 n. sp.

* ——Lamellibranches sans branchies. Bull. Soc. Zool. Fr., XIII., p. 207.

* BINNEY, W. G.—Third supplement to the fifth volume of the terrestrial air-breathing molluscs of the United States. Bull. M. C. Z., XIX., p. 183.

SHIMEK, B.—A new species of fresh-water mollusc. Bull. Lab. Nat. Hist., Univ. Iowa, I., p. 214, 1890.—*Ancylus obliquus* (Nebraska).

HEMPHILL, H.—A collector's notes on variation in shells, with some new varieties. *Zoe*, I., p. 321, 1891.—New forms are varieties of Anodonta.

STERKI, V.—On new forms of Vertigo. Proc. A. N. S. Phila., 1890, p. 31.—*V. callosa* (Mass., Ohio), *V. binneyana* (Manitoba), *V. oscariana* (Fla.), *V. rugulosa* (So. States).

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

WE have had occasion from time to time to animadvert on the attitude of our government towards the intellectual rights of the people as exhibited by its tariff taxation on scientific and and artistic books and apparatus. After several years of persistent applications to Congress, a committee of the American Association for the Advancement of Science has succeeded in obtaining a remission of the 25 per cent. duty levied on scientific books not printed in the English language. All apparatus, and books printed in English, must still pay the tax. Engravings, photographs, etc., not bound in books must still pay duty. All this means a great deal to the science of the country. The money thus obtained by the United States government comes directly from the pockets of a class whose profession is not remunerative, but whose activity it is of the greatest importance to the country to preserve.

But this exaction does not satisfy the authorities of the treasury department at Washington. To make it more onerous it is now ruled by Secretary Foster that engravings, photographs, and other representations of objects, natural and artificial, are not mailable, but must be sent by express. Fancy this government collecting duties on photographs of minerals, insects, geological sections, etc., made in foreign countries and sent to scientific men in this country for their proper information, and for use in the preparation of scientific memoirs and books. Fancy the corps of men employed at large salaries in inspecting and appraising these matters of which they know so much (!) and add to this the express charges that necessarily exceed those of the post on packages weighing from a half ounce upwards. Add to this the time employed in these examinations and transmissions from hand to hand, and the injury easily done to delicate objects in the process, and we find ourselves wondering whether this is a country of which we ought to be proud or not.

The fact is that the Republican party has made itself odious all over the land by the extreme to which it has carried the idea of protection, and the pettiness of its tariff legislation. (Among the objects recently detained or sold under our tariff laws may be mentioned imported snakes, monkeys and postage stamps.) It is a party that has been of great service to the country, but it is estranging more and more the most intelligent class of our citizens. The Democratic party will have a trial in our next Congress, and we will see whether it will do better or not. It is probable that the intellectual interests of the country will have to fight for existence for many years to come, or until it is better represented in the councils of the nation.

—We are glad to see that Major Powell, director of the United States Geological Survey, has withdrawn his proposed scale of colors for his geological maps, in favor of a more reasonable system. The scheme presented by him to the international congress at Washington was more in accordance with that in general use, and though it did not escape some criticism, it passed the ordeal fairly well. It is cause of just congratulation that the country has been spared an expense of many hundreds of thousands of dollars for geological maps, which would have gone far towards making us ridiculous in the eyes of geologists and their friends. The protest of the Naturalist has wrought such a saving to the government that we feel that we are entitled to some special consideration at its hands; say a subscription which will place a copy on the table of each member of the Senate and House of Representatives *in perpetuum*.

—Considerable progress has been recently made in the discovery of the phylogeny of man, two steps of which are noticed in the present number of the Naturalist. In the first place, the men of Spy (Belgium) described by MM. Lohest and Fraipont, of Liége, constitute a well-marked ancestral type within the genus Homo. The Neanderthal skull, represented by a calvarium only, was for a long time without corroborative support as the representative of a race of man, and it was hence supposed by some persons to have belonged to an idiot or a

monster. The discovery of similar crania near Cannstadt, Würtemberg, rendered it certain that the type was widely distributed in Europe, and was not a mere anomaly, and it received the name of the Canstatter race. A lower jaw which presents some simian characters was found at Naulette, Belgium; but as the lower jaw of the Canstatters had not been found, its probable relation to this race could not be proven. The two nearly complete skeletons of Spy have completed the evidence as to the characters of the race. Not only does the lower jaw of Naulette belong to it, but some of the parts of the skeleton display characters more distinctly simian than any known race. The tibia is distinctly shorter than is characteristic of other men, and the femur is curved anteroposteriorly, as in the chimpanzee. Taking it altogether, the Canstatter race answers the expectations founded on theory as to what an ancestral type of man ought to be. Distinct traces of it are said to have been found also in Bohemia France.

The senior editor of the NATURALIST has expressed the view that the anthropoid apes and man were probably descended from the anthropoid lemur Anaptomorphus, without passing the intervention of the true monkeys of the Old-World type (Cercopithecidæ). Probable confirmation of this view has been recently brought forward by M. Ameghino, of Buenos Ayres, in the discovery of a new species of a new genus of quadrumanous mammal from Patagonia, which he calls *Homunculus patagonicus*. At first regarding it as an anthropoid lemur, M. Ameghino now places it in the Simiidæ or Old-World monkeys; but whether he means by this the anthropoids or the true monkeys, is not yet clear. It is, however, apparently intermediate in the characters of the skull and teeth between the lemurine Anaptomorphus and the anthropoid apes, with some human dental characteristics found in the former. From any point of view, the discovery of M. Ameghino is of high importance, since neither lemurs nor Old-World monkeys have been hitherto met with in the fossil or recent state in South America.—C.

RECENT BOOKS AND PAMPHLETS.

ALLEN, J. A.—Description of a New Species of a Big-Eared Bat of the Genus Histiotus, from Southern California.—Further Notes on Maximilian Types of South American Birds.—Notes on a Collection of Mammals from Costa Rica. Extrs. Bull. Am. Mus. Nat. Hist., 1891. From the author.

BAYLEY, W. S.—A Summary of Progress in Mineralogy and Petrography in 1889. From the author.

BELDING, L.—Land Birds of the Pacific District. From the Cal. Acad. Sciences.

BROWN, A. P.—On the Young of *Baculites compressus* Say. Ext. Proceeds. Phila. Acad. Sciences, 1891. From the author.

Bulletin of the U. S. Fish Commission, Vol. VIII., 1888. From the Smithsonian Institution.

CHANCE, H. M.—Geology of the Choctaw Coal Field. From the author.

COOK, O. F., and G. N. COLLINS.—Notes on the North American Myriapoda of the Family Geophilidæ, with Descriptions of Three Genera. Ext. Proceeds. U. S. Natl. Mus., Vol. XIII., pp. 383-396, pls. 33-35. From the Museum.

COULTER, J. M.—Practical Education. From the author.

DARTON, N. H.—Mesozoic and Cenozoic Formations of Eastern Virginia and Maryland. Ext. Bull. Geol. Soc. Am., Vol. II., pp. 431-450, pl. 16. From the society.

DAWSON, G. M.—Note on the Geological Structure of the Selkirk Range. Ext. Bull. Geol. Soc. Am., Vol. II., pp. 165-176. From the author.

DIXON, S. G.—Report of Experiments now Being Pursued in Bacteriological Laboratory of the Academy. Ext. Proceeds. Phila. Nat. Sciences, March, 1891. From the author.

Educational Papers of the Illinois Science Teachers, 1889-1890. From S. A. Forbes.

EDWARDS, C. L.—Some Tales from Bahama Folk-Lore. From the author.

FABRINI, E.—I Machairodus (megantereon) del Valdarno Superiore. From the author.

FLETCHER, R.—The New School of Criminal Anthropology. Ext. *Am. Anthrop.* July, 1891. From the author.

FOX, L. W.—Resection of the Optic Nerve. Reprint *Med. and Surg. Rept.*, May 1891. From the author.

GALLOWAY, B. T.—Treatment of Nursery Stock for Leaf Blight and Powdery Mildew. Circular No. 10, U. S. Dept. Agri., Div. Veg. Pathology. From the Dept.

GOODWIN, E. J.—A Series of Revelations, Physical and Mathematical. From the author.

HARLÉ, E.—Note sur les Mandibules d'un Canidé du genre lenon, avec 4 figures Ext. Arch. d'Anthropologie, No. 2, Mars-Avril, 1891. From the author.

HENSOLDT, H.—The Limits of Scientific Inquiry. Reprint *Journ. Franklin Inst.*, May, 1891. From the author.

JORDAN, D. S.—List of Fishes Obtained in the Harbor of Bahia, Brazil, and in Adjacent Waters. Ext. Proceeds. U. S. Natl. Mus., Vol. XIII., pp. 313-336. From the Smithsonian Institution.

LANGDON, F. W.—Surgical Anatomy of the Brain. Reprint *Cin. Med Journ.*, April, 1891. From the author.

MALLY, F. W.—The Boll Worm of Cotton. Bull. No. 24, U. S. Dept. Agri., Division Entomology. From the Smithsonian Institution.

MINOT, C-S.—A Theory of the Structure of the Placenta. Sonder-Abdruck aus *Anatomischer Anzeiger*, 1891, Nr. 5. From the author.

MOCQUARD, M. F.—Sur une Collection de Reptiles et de Batraciens rapportés des pàyo Cornalis et de Zanzibar par M. G. Revoil. Extrait Mémoires Soc. Philomatique, 1888.——Sur les Ovaires de la Baudroié.—Revision des Clinus de la Collection du

Museum.—Sur une Collection de Reptiles du Congo. Extraits Bull. Soc. Philomatique de Paris, 8th Serie, t. 1.—Sur un nouvean genre de Bleniidæ voisin des Clinus (Paraclinus); do. 1885.—Note sur un nerf Cardiac naissant des ganglions cérébroïdes chez la Langonste; do. 1883.—Observations sur des embryons de *Pelophilus madagascariensis;* do. 1887.—Sur une nouvella espce d' Elaps, *E. heterochilus;* do. 1886.—Contribution à l' histoire du genre Psammodynastes, do. 1887.—Second Contribution à l' histoire du genre Psammodynastes; do. 1888.—Sur une nouvelle espèce d'Atractaspis (*A. leucura*); do. 1885.—Du genre Heterolepis et des espèces qui le Composent, dout trois nouvelles; do. 1886.—Sur les Ophidiens rapportés du Congo par la Mission de Brazza; do. 1886.—Sur une collection de Reptiles et de Batraciens des isles Borneo et Palawan. Ext. du Compte-Rendu des Séances du Congrès Intern. de Zool., 1890. From the author.

MORENO, F. P.—Esploracion Arqueologica de la Provincia de Catamarca. Estracto del informe Annual Correspondiente á 1890. From the author.

NEHRING, A.—Ueber Tundren und Steppen der Jetzt und Vorzeit, mit besonderer Berücksichtigung ihrer Fauna. From the author.

POUCHET, M. G.—Nouvelles Observations sur la Sardine océanique. Proceeds. Paris Acad. Sciences, July, 1889.

RILEY, C. V.—Report of the Entomologist of the U. S. Dept. Agri. for 1890.—Destructive Locusts. U. S. Dept. Agri., Div. Entomol., Bull. 25.—The Insectivorous Habits of the English Sparrow. Ext. Bull. No 1, Div. Econ. Ornith. and Mam., U. S Dept. Agri.—Insects Affecting the Hackberry. Ext. Fifth Rept. U. S. Entomol. Com.—Rept. of the Entomologist, 1889. Ext. Ann. Rept. Dept. Agri., 1889. From the Smithsonian Institution.

Report of the Manchester Museum, Owens College, October 1st, 1889, to September 30th, 1890.

Report of the Missouri Botanical Gardens, 1891. From the Board of Trustees.

Reports of Observations and Experiments in the Practical Work of the Division. Bull. No. 33, U. S. Dept. Agri., Div. Entomol.

ROSA, D.—Le Nov. Latin. Ext. Boll. dei Mus. Zool. ed Anat. Comp., October, 1890. From the author.

RYDER, J. A.—A Physiological Hypothesis of Heredity and Variation. Ext. AM. NAT., January, 1890. From the author.

SHUFELDT, R. W.—Some Comparative Osteological Notes on North American Kites. Ext. *Ibis*, April, 1891. From the author.

Thirty-second Annual Report of the Trustees of the Cooper Union for the Adv. of Science and Art, May, 1891.

Transactions of Kansas Academy of Science, Vol. XII., 1889-'90. From B. B. Smyth.

Twenty-fifth Annual Report on the Colonial Museum and Laboratory. From Sir James Hector.

Twenty-ninth Report of the Secretary of the State Board of Agriculture of Michigan. From A. J. Cook.

WARD, L. F.—The Transmission of Culture. Reprint from the *Forum*. From the author.

WHITEAVES, J. F.—The Fossils of the Devonian Rocks of the Mackenzie River Basin.—Contributions to Canadian Paleontology, Vol. I., Pt. III. From the Canadian Geol. and Nat. Hist. Surv.

WHITMAN, C. O.—Description of *Clepsine plana*.—Spermatophores as a Means of Hypodermic Impregnation. Reprint *Journ. Morph.*, Vol. IV., No. 3. From the author.

WINCHELL, N. H.—Iron Ores of Minnesota. Bull. No. 6, Geol. and Nat. Hist. Surv. Minn. From the author.

WOLFF, J. E.—On the Lower Cambrian Age of the Stockbridge Limestone. Ext. Bull. Geol. Soc. Am., Vol. II., pp. 331-338. From the society.

RECENT LITERATURE.

Doelter's Allgemeine Chemische Mineralogie[1] is a collection in logical order of all those facts relating to the chemistry of minerals that are so interesting to the modern mineralogist. After discussing crystal structure in its relation to the chemical molecule, and defining isomorphism, isomerism, polymorphism, and isoganism, and briefly touching upon morphotropism, the author describes the ordinary methods of chemical analysis, and then occupies about seventy pages in a treatment of the subject of mineral synthesis. It is this latter portion of the volume that is most interesting. The author is himself such an indefatigable worker in this line of investigation that his remarks on the manufacture of minerals must be accepted as worthy of great confidence. Everywhere in these pages he writes himself master in his chosen study. He distinguishes clearly between terms that seem to approach each other in meaning, and defines them in such simple language that they need no longer be misunderstood. He divides the subject into two parts,—viz., the recrystallization of mineral substances already prepared, and the production of minerals and their crystallization. Under each head the methods that have proven most satisfactory for the purposes desired are given in detail, and following these is a brief but sufficiently full account of experiments that have yielded mineral products, with references to the articles in which they are described. Nearly every synthesis that has ever been made may be traced by the aid of the book,—a feat that has heretofore been possible only with the greatest difficulty. The last three parts of the volume deal with the chemical changes effected in minerals by change in temperature and by the action of solvents, the formation of minerals in nature, and the chemical composition and constitution of minerals.

Though the book is not as complete as is Lehmann's Molecular Physik in its treatment of those subjects that both discuss in common, it serves as a supplement to Lehmann's wonderful production, and demands a place beside this in every mineralogist's library.—W. S. B.

Fewkes's Cœlenterates and Echinoderms.[2]—Dr. Fewkes has presented the New England student of the old group of Radiates a

[1] Leipzig, 1890, pp. 278, illus. 14.

[2] An Aid to the Collector of the Cœlenterata and Echinodermata of New England. By J. Walter Fewkes. Bulletin Essex Institute, Vol. XXIII., pp. 91. Salem, 1891.

handy aid to the identification of the more common littoral and pelagic species. First comes an account of the methods of collecting (not a word concerning modern methods of preserving specimens), and then the synopsis of the forms enumerated, something after the fashion of an analytical key. Numerous original figures will aid the student in his identifications. The arrangement of the divisions recognized is hardly up to date, and in some cases it is open to serious criticism. Thus, for instance, Dr. Fewkes associates the Ctenophores with the Hydrozoa as a subdivision ("order"), equal in rank to the Trachymedusæ (!) The recent important conclusions as to the position of the Scyphomedusæ are ignored. The manubrium is defined as "a fleshy protuberance of folded membrane"; by implication the Ctenophores (p. 13) would be included in the naked-eyed Medusæ; the Madreporaria (p. 55) are made to include Pennatulacea, Gorgonacea, and Alcyonacea (!), while (p. 57) the Alcyonacea are placed under the Gorgonacea, etc. We have been moved to these comments from the fact that beginners are likely to use this in the identification of their specimens, and may thus obtain erroneous ideas of relationships. The lapses are too numerous for a man with Dr. Fewkes's extensive knowledge of the group. The concluding portion of the paper, which consists of a list of times of occurrence of marine larvæ at Newport, is the most valuable part of it.

General Notes.

GEOLOGY AND PALEONTOLOGY.

The Californian Cave Bear.—In the NATURALIST for 1879, page 791, I described a species of bear, previously unknown, which was represented in my collection by a nearly complete skull. The specimen was found in a cave in Shasta county, California, and was in excellent preservation at the time of its discovery, but it had suffered from the ill usage of curious persons. The rami of the lower jaw had been given away and lost, the zygomata had been chopped off, and the canine teeth broken away. The remaining cranium is, however, a fine specimen, and was originally partially covered by stalagmite. A large part of this has been removed, enough being left to demonstrate its geological position.

The species was named *Arctotherium simum* Cope. It possesses several points of interest. In the first place it is nearly related to the bear of the Pampean epoch of South America, *Arctotherium bonærense* Gervais, which is found in Argentine in association with the remains of gigantic sloth Toxodonts, Glyptodonts, etc. It differs from its Pampean ally in several important respects. The muzzle resembles that of the latter in its extreme brevity, so that both alike were "pug-nosed," in great contrast to the existing bears. The relative proportions of the remainder of the skull are markedly different in the two species, being more elongate in the *A. simum* than in the *A. bonærense*. The penultimate premolar, as in the latter, is two-rooted, but it stands in line with the dental series, and not oblique to it and overlapping the other premolars, as in *A. bonærense*, a character which results from the greater abbreviation of this part of the maxillary region in the latter species. There is also a large median third incisive foramen in the Californian species, which is wanting or very small in the Argentine.

As compared with the species of true bear (genus Ursus) the Californian cave bear presents many peculiarities apart from the characters which distinguish the genus Arctotherium. While the proportions of the posterior part of the skull are much as in the true Ursi, the anterior portion is much shorter and wider. The palate and forehead are half as wide again as in the grizzly (*U. horribilis*), or the European cave bear (*U. spelæus*), and the front is much more convex. It is not only con-

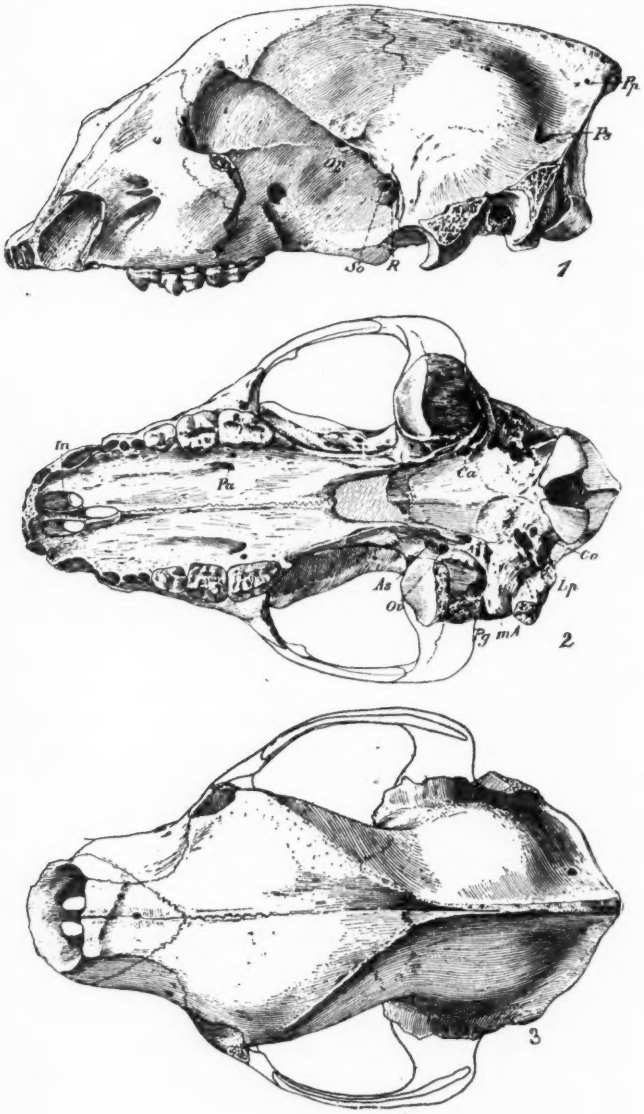
vex anteroposteriorly, as in the *U. spelæus*, but it is regularly convex transversely, which it is not in that species. The two species of Ursus named have relatively larger molar teeth than in the other species of the genus, but in the Californian cave bear they are relatively still larger, and especially broader, having a swollen area between the tubercles not recognizable in the m. I. in those species, and but feebly in m. II. The canines are also relatively larger, judging from the size of their alveoli. Another peculiarity is the presence of three infra-orbital foramina. Ameghino[1] represents two in the *A. bonærense*.

In dimensions this skull equals that of the largest grizzly bears, and the average of the European cave bears. Some of the latter exceed it in length, but the form in the *A. simum* is more robust than in either of those species. To judge by the skull alone, the Californian cave bear was the most powerful carnivorous mammal which has lived on our continent. Its short nose and full rounded forehead must have given it a peculiar physiognomy. The living mammal which approaches nearest in general appearance is probably the rare black-and-white bear of Thibet, the *Æluropoda melanoleuca* of Milne-Edwards, which connects the Arctotheria with the extinct Hyænarctos of the Neocene ages. It was a much larger animal than the *A. melanoleuca*. Unfortunately we can form no idea as to the color of its fur.

Like its South American congener, the Californian Arctotherium was associated with gigantic sloths (Mylodon), and it belongs to a fauna which has left in other localities in North America Megatheriums and Glyptodonts. In other words, it is one of the forms which justify the statement which I have made elsewhere (Proc. Phila. Acad., 1867, p. 156; Proc. Amer. Philos. Soc., 1871, p. 99), that during the late Pliocene or early Plistocene an invasion of Mammalia from the south took place. I have suspected that this invasion originated after the north had been covered by an ice sheet which prevented immigration from Asia and permitted it from the south, since no predecessors of the southern types of Mammalia had been found at that time in older North American horizons. Since that was written no ancestral forms of the Megatheriidæ and Arctotherium have been found, but ancestors of several other members of the South American fauna have been discovered. Thus a genus of Glyptodontidæ (Caryoderma Cope) has been found in the Upper Miocene (Loup Fork) of Kansas; and a primitive type of peccaries (Bothrolabis Cope) has been obtained from the middle Miocene (John Day) of Oregon. Primitive forms of tapirs occur in the Upper Miocene (Loup Fork; genus Tapiravus Marsh).

[1] Mamm. Foss. Argentinos, Pl. III., Fig. 1.

PLATE XXI.



Arctotherium simum Cope; $\frac{1}{3}$.

It has been assumed that South America received its llamas and horses from North America on abundant evidence; and it is now probable that she received the tapirs and peccaries from the same source, since no early types of these lines have been revealed in South American formations by recent extensive researches in that continent. Sloths and Glyptodons are, however, shown by these investigations to have existed in South America during the Eocene period, so that our primitive Glyptodont and Caryoderma may have been an early immigrant from that continent, while the sloths came later. As regards bears, it is well known that we have not found their ancestral types in either of the Americas, but that they are abundantly found in the Neocenes of Europe and India. Arctotherium is both the earliest and most primitive form which we possess, and the time of their appearance is the same in both North and South America. They probably reached this continent at a comparatively late date, but earlier than the arrival of the true genus Ursus. Between the two genera occurs the Tremarctos, of which one species exists still in the Andes, *T. ornatus* Cuv., and one exists in the fossil state, *T. etruscus*, in Europe (Cuvier, Oss. Fossiles, Pl. 189, Fig. 8). This indicates the possible origin of the genus Ursus on the American continent, as well as on that of Eurasia; but prior to Arctotherium America has nothing, while Eurasia has everything.—E. D. Cope.

Explanation of Plate.

Skull of *Arctotherium simum* less than one-fifth natural size, linear.

Fig. 1, profile; 2, from below; 3, from above.

Foramina: In., incisive; Pa., palatine; Op., optic; So., sphenoörbital; R., rotundum; As., alisphenoid; Ov., ovale; Pg., postglenoid; Ca., carotid; MA., meatus auditorius externus; Lp., lacerum posterius; Co., condylar; Ps., postsquamosal; Op., postparietal.

The Work of White Ants in Australia.—In a recent paper on Central Australia, published in the Proceedings of the London Geographical Society, June, 1891, Mr. Charles Chewings quotes Mr. Woodward as authority for the statement that extensive alterations in the surface of the country are due to the industry of the white ants. Mr. Woodward has traveled over a large part of Australia, and he has had the especial advantage of examining the so-called desert sandstone formations, to the disintegration of which we attribute those endless sandhills that have been so often described as a dessert, but which cannot be strictly so called, since this sandy land is covered, often very thickly, with trees and shrubs. He is of the opinion that a

"great deal of work is done, vastly altering the appearance of the country, by what may appear to many people at first sight a perfectly ridiculous agency,—viz., the white ants; but after passing over the plains or through the thickets, where their hills are so numerous that it is difficult to drive through them, the immense amount of their work can be better appreciated. The clay, cemented with resinous matter, with which they build their nests is as hard as brick, and when these fall to pieces they form clay flats almost impervious to water, and so hard that they will bear a great deal of traffic without being cut up. The work of these creatures can be studied in all stages: first in the thickets where they are commencing work; then in the more open country, where they have got the upper hand of the timber; next on the plains, where half the hills will be found deserted; and lastly on the clay flats, where they have almost entirely disappeared and the scrub has begun to grow again. Another remarkable thing about these nests is the amount of iron they contain, for when a tree has been burnt in which they have built a nest there will be found at its base a mass of iron clinker, looking just as if it had come out of a furnace."

More New Mammalia from the Eocene of Patagonia.—M. F. Ameghino describes in a new extract from the *Revista* for August, 1891, the results of the last exploration in Patagonia of M. C. Ameghino. These consist of no less than 173 species of Mammalia, by far the greater number of which are new to science.

The most interesting novelty described is a new species of a new genus of Quadrumana, which has the dental formula of the Old-World monkeys, with especial resemblances to that of man. This is seen especially in the small canine teeth, which are not followed by a diastema. This genus accentuates the proposition which I have advanced, that the line of the Anthropoid apes and man has been derived directly from the Anthropoid lemur Anaptomorphus of the Eocene period. The *Homnuculus patagonicus*, as this remarkable form is called by Ameghino, certainly has considerable resemblance to the former genus, but is more like the true monkeys in its quadritubercular lophodont molars.

The Mammalia described are referable to the following orders:

Marsupialia (?)		38
Edentata		62
Glires		23
Bunotheria	(Insectivora)	1
	(Creodonta)	8
Taxeopoda	(Litopterna)	23
	(Quadrumana)	1
Toxodontia		13

Among the important discoveries are the numerous ? Marsupialia. Several of these belong to the genera allied to the Plagiaulacidæ already described by M. Ameghino. The author has discovered a fact long since (AMERICAN NATURALIST, 1884) pointed out by myself,—viz., that the cutting inferior molar of the Plagiaulacidæ is not homologous with the cutting tooth of the mandible in the Marsupialia Diprotodonta, but is one position posterior to it. I regarded it as the P. m. i. (iv.), but Ameghino, following Thomas's nomenclature, regards it as the m. i. Garzonia g. n., Epanorthus, and Microbiotherium are made types of new families with apparent reason. So is Abderites, but no sufficient ground appears to be given inits case. Three new genera and seven new species are referred to the existing family Thylacynidæ, thus bringing to light the lost relatives of the Tasmanian wolf-opossum. An affinity between these animals and the Creodonta of the same age is insisted on.

In a previous essay Ameghino shows that Propalæhoplophorus has distinct vertebræ, and represents therefore a family entirely distinct from the Glyptodontidæ. Cochlops belongs to the same family. He adds much to our knowledge of Peltephilus, which M. Mercerat declares to be identical with Cochlops. Family names appear to be rather carelessly used among the Glires; there are too many of them. Among Litopterna, Mesorhinus Amegh. is made the type of a new family, which has the external nares placed more anteriorly than in the Macraucheniidæ; he includes in it the genera Mesorhinus, Oxyodontotherium, Cœlosoma, Theosodon, and the new Pseudocœlosoma. Several important points in the structure of Homalodontotherium are added; among the rest, that it has an ungrooved astragalar trochlea. A new species is described, and a new genus (Diorotherium) is added to the family. Eleven new species are added to the Proterotheriidæ. Astropotheriidæ are still referred to the Amblypoda Taligrada, and a new genus (Astrapodon) is added. Many striking novelties are added to the Toxodontia.

This contribution increases our interest in this wonderful fauna, and leads to the hope that we shall soon see the illustrations of some of the forms already promised by M. Ameghino.—E. D. COPE.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The gabbros of the United States, which, until a few years since, were scarcely known, have recently been studied in typical regions. Prof. Chester[2] has lately communicated the results of his study of the great belt of these rocks crossing the northern part of Delaware and running southwesterly until it unites with that investigated by Williams in the Baltimore area. The rocks of the Delaware region differ from those of the Maryland area in that the former very frequently contain quartz. The normal rock is a hypersthene-gabbro, containing brown hornblende and biotite. This graduates into a more acidic phase by an increase in quartz, and at the same time an equally noticeable gain in biotite, until it becomes more properly a pyroxene-granite than a gabbro. On the other hand, by the increase of brown hornblende, regarded as original, and the assumption of a schistose structure, the normal gabbro grades into a gabbro-diorite or a hornblende-gneiss. Further, uralitization of the pyroxene gives rise to green schistose rocks, identical in nearly all of their characteristics with the gabbro-diorites of the Baltimore region. The author describes in detail each type found by him, and gives analyses of the feldspars of many of them. The plagioclase of the typical diallage-hypersthene gabbros is Ab_1An_2, while that of the more acid biotitic rock is Ab_3An. Gabbro-diorite is the name given to the schistose rock in which brown hornblende predominates over pyroxene. Since the hornblende is regarded as original, there would seem to be no sufficient reason for not calling the rock a diorite-schist, thus reserving gabbro-diorite for those schistose phases of gabbro in which the hornblende is largely secondary. By the loss of nearly all of their pyroxene the gabbro-diorites of both classes pass into hornblende-gneisses. In the gabbro-granites, derived from the gabbros by an increase in quartz and biotite, there are evidences of pressure action in the shattered condition of the quartz and feldspar. Norites, described by the author, are aggregates of quartz and feldspar, in which are imbedded phenocsyts of hypersthene.

——Messrs. Campbell and Brown[3] add two new varieties to the Triassic traps of Virginia, differing from those described from more northern localities in that they contain hypersthene. One is a hypersthene-

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. U. S. Geol. Sur., No. 59.

[3] Bull. Geol. Soc. Amer., Vol. II., p. 339.

diabase, and the other an olivine-hypersthene-diabase. The latter has been found only in one place,—viz., two miles north of Rapidan Station on the Virginia Midland R. R. The hypersthene-diabase occurs not only in various places in Virginia, but it has also been found north. It is slightly ophitic, inclining somewhat to the porphyritic. Its feldspar is a basic labradorite of the formula Ab_3An_5. The pyroxenes are a slightly pleochroic, polysynthetically twinned diallage, and a strongly pleochroic hypersthene. The former contains numerous microlitic inclusions, while the latter is free from them. Quartz, apatite, and green hornblende are accessories. In the olivine rock the olivine is largely idiomorphic, and is in large grains. The other constituents are the same as those of the hypersthene-diabase. The paper contains an excellent series of analyses of the rocks and their most important components.——Barrois[4] has given us a masterly discussion of the diabases and diabase-porphyrites of Silurian age, occurring as dykes and flows in Menez-Hom, Finistère, France. The diabases he divides according to structure into granular and ophitic types. Among the former are olivine-bearing varieties, sometimes containing hypersthene, and olivine-free kinds, containing orthoclase, quartz, and occasionally porphyritic augite. The porphyrites are divided into andesitic varieties in which the feldspar-microlites are older than the augite, and into variolitic kinds with feldspar younger than augite. A large part of the rocks of the region studied occur in the form of tuffs, in which the cementing material is shale, limestone, or sandstone, and the fragments are sometimes large enough to be called bombs. Schalstein is also common. The contact effects noticed in the eruptives are insignificant in amount. The schists in contact with the bedded diabases are spilosites, containing nodules of chlorite. The most interesting contact effects are those noticed in the case of nodules originally consisting of pyroxene and quartz. Under the influence of sea-water made hot by submarine ejections, these nodules have become zonal, in which the two zones differ principally in the size of their constituents, as both contain pyrite, albite, quartz, sphene, and limonite. In conclusion, the author makes some general remarks on the study of ancient volcanoes, and gives quite a good résumé of the work done in this direction.——A dyke of basic rock on Stop Island, in Rainy Lake, Canada, consists of diabase-porphyrite with an almost aphanitic texture on its contact. It contains occasional rounded masses of augite. Four feet from the contact it is a diabase, with the ophitic texture, and at fifteen feet from the contact it is also a diabase. Here, however, a

[4] Bull. Serv. Carte Geol. d. Fr., No. 7, 1890.

portion of the augite is in idiomorphic crystals and in polysomatic grains, while another portion is in allotriomorphic masses between the feldspars. In the middle of the dyke the texture is gabbroitic, while hornblende replaces the augite. Quartz is also a prominent constituent of the center of the dyke, whereas it is only sparingly present at fifteen feet from the contact, and is entirely absent at the contact. Dr. Lawson [5] calls attention to these facts, and states that in the single geological unit represented by the mass of the dyke we must distinguish between three distinct rock types if we make use of present methods of nomenclature. He further thinks that the phenomena indicate that rate of cooling, rather than pressure, is the principal cause determining the textural condition assured by a solidifying magma. Other dykes exhibiting similiar pecularities are described from other localities in the Rainy Lake region. All show larger percentages of SiO_2 in their middle portions than are shown near their contacts,—a fact ascribed to the separation of basic augite, magnetite, etc., in those portions that cooled rapidly.——The larger part of the area of the Dippauer Gebirge in Northwestern Bohemia is covered by basalts, occurring in flows, dykes, and bosses, with their tufas and conglomerates. These are cut by phonolites and andesites, in the former of which are large grains of perofskite, in some cases showing parallel striations in parallel light. The basalts occur in all varieties, according to Clements.[6] The central portions of the hills are composed principally of leucite and nepheline basalts and the closely related rocks, nephelinites, leucitites, nepheline and leucite tephrites, and leucite-basanites. On the peripheries of the mountains are feldspathic basalts, limburgites, and augites. Among the most interesting features of the several rocks noticed are corroded biotite plates, surrounded by rims formed of secondary crystals of the same mineral, in the nepheline basalts; pseudomorphs of phillipsite after olivine in the leucitites; augite crystals with secondary twinning lamellæ produced by pressure in the nephelinites and feldspathic basalts; zonal augites in the leucitites, with an extinction varying gradually from the center to the periphery, and others with the hour-glass structure and an outer zone containing colorless microlites with their long axes lying parallel to the bounding walls of the crystals; and sanidine inclusions surrounded by augite crystals in leucite basalt. Leucite is more abundant in close proximity to an orthoclase inclusion in the last-mentioned rock than elsewhere in the rock-mass. Of the feldspathic basalts it was found that the youngest is most acid.——

[5] *Amer. Geol.*, VII., 1891, p. 153.

[6] Jahrb. d. Kais-Kön. geol. Reichsanst, 1890, XL., p. 317.

Dr. Wolff[7] calls attention to the existence of ottrelite and ilmenite schists among the Paleozoic crystalline rocks of the Taconic region in the Green Mountains and in Massachusetts and Rhode Island. The Rhode Island rocks comprise micaceous schists and graywackes. In the former are grains of quartz, scales of muscovite, and occasional small patches of chlorite and bands of a mixture of graphite and ilmenite. Ottrelite crystals are scattered indiscriminately among the other constituents. In the graywacke the ottrelite occurs in irregular plates, which are free from optical deformities, while the other components of the rock give evidence of having been subjected to intense pressure. Even the mica, which owes its presence to metamorphic agencies, is bent and twisted. The absence of optical deformities in the ottrelite points to a very late origin for this mineral. The author also briefly describes a graphite-schist with ilmenite plates from Rhode Island. All the Rhode Island rocks are known only in boulders.——Singaelia[8] describes specimens of glassy lava from Vesuvius in the cabinet of the University of Berlin. Those from the streams of 1753 and 1809 consist largely of glass in which are tiny perfectly formed crystals of leucite and olivine and good crystals of augite and plagioclase. Other leucites are skeleton crystals, with their edges sharply defined, but their faces hollow. Two other specimens contain glassy portions between crystalline portions. Of these, one from the flow of 1822 contains hornblende, and another, whose age is unknown, has its anorthite and other crystals surrounded by rims of little rutile needles.——The ophiolites of Essex Co., N. Y., and the serpentines from Aqueduct Shaft No. 26, New York city, and from near Easton, Pa., have resulted by metasomatic changes from pyroxene, according to Merrill.[9] In the first-named rock the larger part of the serpentine, which is light green in color, is from a colorless pyroxene. Small particles of a darker-colored serpentine are scattered through the rock, and in these are enclosed graphite scales. Thin sections of these portions show them to consist of calcite, dolomite and serpentine. Originally they were probably composed of the first two minerals only. The serpentine is a subsequent formation, but by what method it was produced the author has not succeeded in determining.——A remarkable example of a Huronian volcanic tufa, from the nickel region at Sudbury, Canada, is reported by G. H. Williams[10] as composed of a glass breccia

[7] Bull. Mus. Comp. Zool., XVI., No. 8, p. 159.

[8] *Neues Jahrb. f. Min.*, etc., B.B. VII., p. 417.

[9] Proc. U. S. Nat. Mus., XII., p. 595; Washington, 1890.

[10] Bull. Geol. Soc. Amer., Vol. II., p. 138.

with its original flowage structure and the shapes of its included fragments well preserved through silicification. Calcite, glassy feldspar, and chlorite are the only minerals, with the exception of quartz and chalcedony, that can still be detected in the rock.——In a report on the iron ores of Minnesota,[11] by Messrs. N. H. and H. V. Winchell, Dr. Hensoldt describes a few of the rocks associated with the ores. Among them are various green schists, jaspers, chalcedony, etc.

Mineralogical News.—*American Minerals.*—Within the last few months a large number of articles have appeared containing the results of investigations of American minerals. Prof. Genth[12] reports some analyses of interesting minerals from the United States and Mexico. Bladed crystalline masses of *tetradymite* from Bradshaw City, Yavapai Co., Ariz., consist apparently of orthorhombic plates, whose composition corresponds to $Bi_2(S_{1\frac{1}{2}}Fe_{\frac{1}{2}})$ [Bi = 62.23; S = 4.50; Fe = 33.25]; so that in all probability the mineral belongs in the stibnite group. *Ziron* from Mars Hill, Madison Co., N.C., yielded him: SiO_2 = 31.83; ZrO_2 = 63.42; Fe_2O_3 = 3.23; Loss = 1.20. Its specific gravity is 4.507. Small crystals of *scapolite* associated with garnet at Elizabeth Mine, French Creek, Pa., gave:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	CO_2	Loss	Sp. Gr.
52.30	23.68	.58	.05	12.36	6.29	.77	2.63	1.50	2.675

Both minerals appear to be alteration products of essonite. The garnet is brownish-gray or ash-gray in color. Its composition is given opposite (I.). A titaniferous variety, from the Jones Mine, Henderson Co., N. C., has a composition as opposite (II.):

	SiO_2	Al_2O_3	Fe_2O_3	FeO	Mgo	CaO	MnO	TiO_2	CO_2	Loss	Dens.
(I.)	41.42	18.09	10.81		.59	26.19	.88		1.71	.51	3.390
(II.)	35.56	4.43	20.51	1.88	.17	31.90		4.58		.55	3.738

Analysis of *pyrite* from French Creek, Pa., and of *allanite*, are also given in the same paper. The green substance associated with the gold at Los Cerillos, N. M., supposed to be turquoise, was found in one instance to be *chromiferous clay*, and in another to be *cupriferous quartz.* Pseudomorphs of the latter mineral after stibnite are mentioned by the author as occurring at Durango, Mexico. In another article Prof. Genth[13] gives the result of an examination of *lettsumite* from the Cop-

[11] Bull. No. 6, Nat. Hist. and Geol. Survey of Minn., p. 429.

[12] *Amer. Jour. Sci.*, August, 1890, p. 114.

[13] Ib., p. 118.

per Mountain Mine, near Morenci, Arizona, and from the American Eagle Mine, Copperopolis, Utah. In the first-mentioned locality, the substance forms incrustations of small, blue, fibrous tufts in a quartz gangue. Upon alteration it gives rise to a greenish-yellow, and finally to a fibrous yellowish-white material, often associated with hydrous aluminium sulphate. The Copperopolis specimens are velvety coatings of azure-blue silky fibers on a mixture of clay and lettsumite. The analyses of the two varieties, which are almost identical in composition, lead to the formula $Cu_4Al_2(OH)_{12}SO_4 + 2H_2O$.

SO_3	CuO	Al_2O_3	Fe_2O_3	H_2O	Ins.	Sp. Gr.
12.49	46.71	16.47	1.34	21.89	.44	2.737

——Crystallized *metacinnabarite* (which has heretofore been found only in amorphous masses) has recently been discovered in the New Almaden Mine, California.[14] The crystals are implanted on quartz containing cinnabar crystals, which in turn occurs incrusting a selvage of clayey material forming an ore seam, whose origin is referred to solfataric action on the country rock. Spheres of a black organic substance are imbedded in the metacinnabarite, whose density is 7.118. Its composition follows:

S	Hg	Fe	Co	Zn	Mn	$CaCO_3$	Quartz	Org. Matter
13.68	78.01	.61	tr.	.90	.15	.71	4.57	.63

The crystals are rhombohedral and hemimorphic, with an acute pyramidal habit, and an axial ratio $a : c = 1 : .2372$.——In rotted galena on a contact between limestone and mica-schist at Mountain View Lead Mine, near Union Bridge, Md., Williams[16] has found small but good crystals of *anglesite* and *cerussite*, and a single crystal of *sulphur*, all of which are products of the decomposition of the lead ore. The three principal types of the anglesite are prismatic, parallel to the brachy-axis, with $P\breve{\infty}$ and $P\bar{2}$ predodominating, cuboidal, with $P\breve{\infty}$ and $\infty P\breve{\infty}$ the principal forms, and prismatic in the direction of the macro-axis, with $\frac{1}{4}P\breve{\infty}$ determining the habit. The cerussite presents a great variety of habits. One elbow twin is peculiar in that each of the two individuals is bounded on the inner side by $\infty P\breve{\infty}$, while the outer side contains in addition the brachy-domes $\frac{1}{2}P\breve{\infty}$, $P\breve{\infty}$, and $2P\breve{\infty}$. The sulphur crystal is very small, but it contains thirteen forms, of which eight are in the zone of the ground-pyramid and one $\frac{3}{5}P$ is new.——The *polycrase* reported by Messrs. Hidden and Mackintosh[16] as oc-

[14] Melville. Ib., Oct., 1890, p. 291.

[15] Johns Hopkins Univ. Circ., No. 87.

[16] *Amer. Jour. Sci.*, June, 1890, p. 302.

curring four miles from Marietta, S. C., and in Henderson Co., N. C. has been examined by these gentlemen, who find it forming tabular crystals with $\infty P\overline{\infty}$ largely developed, and the new forms oP, $\frac{1}{3}P\overline{\infty}$, and $P\frac{3}{2}$ occurring on it. Several of the crystals are apparently twins, and those from South Carolina, when doubly terminated, appear to be both hemihedral and hemimorphic. The material for analysis was obtained by washing kaolinized coarse granite. This, when corrected for impurities, yielded:

	Cb_2O_5 TiO_2 Y_2O_3 (etc.)	FeO	UO_3	PbO	Fe_2O_3	CaO	H_2O	Ins.	SiO_2
N. C.	19.48 29.31 27.55	2.87	13.77				5.18		
S. C.	19.37 28.51 21.23	2.47	19.47	.46	.18	.68	4.46	.12	1.01

Prof. Rowland, to whom the South Carolina specimens were submitted for microscopic study, found in them large amounts of scandium.——The same investigators[17] have examined lemon-yellow *auerlite* from Price's Land, Henderson Co., N. C., and a few other rare minerals. The auerlite has a density of 4.051–4.075, and a composition: $P_2O_5 = 8.58$; $SiO_2 = 6.84$; $ThO_2 = 72.16$ (diff.); $Fe_2O_3 = 1.78$; $H_2O = 10.64$. *Sulphohalite* they find to be probably tetrahedrally hemihedral. The *fayalite*[18] of Cheyenne Mt., Colorado, occurs sometimes in the granite in masses weighing as much as ten pounds. Analysis: $SiO_2 = 27.66$; $FeO = 65.79$; $MnO = 4.17$; $CaO = .47$. Mr. Hidden[19] also announces the discovery of *bastnaesite* and *tysonite*, near Manitou, Colorado, in a mass weighing over six kilograms, and gives four new localities for the occurrence of *fergusonite*, as follows: Associated with allanite, at Amelia Court House, Virginia; accompanying zircon, in the mines at Storeville, Anderson Co., South Carolina; at the Grassy Creek Mica Mine, in Mitchell Co., N. C.; and in the gold placers near Golden, Rutherford Co., N. C. The *orangite* of Landbö, Norway, is declared to be *uranothorite*. Its density is 4.322. A partial analysis gave 11.97 per cent. H_2O; 18.50 per cent. SiO_2; 52.53 per cent. ThO_2; 9 per cent. UO_3, and small quantities of other substances.——Associated with beryl and spodumene in the granite of the Nickel Plate tin claim, in Pennington Co., South Dakota, are nodules of a phosphate near *triphyllite* in composition. It is dark green in mass, and light yellowish-green in thin splinters. Its hardness is 5, and density 3.612. Analysis[20] yielded:

P_2O_5	FeO	MnO	CaO	MgO	Na_2O	K_2O	Li_2O	F	Ign.	Gangue
38.64	25.05	15.54	5.53	1.50	7.46	2.00	.28	.69	.73	2.47

[17] Ib., May, 1891, p. 438.

[18] Cf. *Amer. Jour. Sci.*, March, 1885, p. 25.

[19] Ib., p. 439.

[20] Headdon. *Amer. Jour. Sci.*, May, 1891, p. 416.

——Penfield[21] has analyzed an *aurichalcite*, occurring in narrow seams in an impure limonite from Utah, which yielded an average:

CO_2	CuO	ZnO	H_2O	CaO	Dens.
16.36	19.37	53.09	9.92	.61	3.57

$= 2RCO_3 3R(OH)_2$, in which R = Zn and Cu, with CuO:Zno = 2:5.——Inexhaustible beds of *beauxite* have been discovered near Little Rock, Arkansas, and near Benton in the same state. According to Branner[22] they are genetically related in some unknown way with eruptive granites. The material is pisolitic in structure. A partial analysis of one specimen gave: $Al_2O_3 = 55.64$; $SiO_2 = 10.38$: $Fe_2O_3 = 1.95$; $TiO_2 = 3.50$; Loss = 27.62.——An analysis of *halotrichite* from Pitkin Co., Colorado, is given by Bailey[23] as follows:

SO_3	Al_2O_3	Fe_2O_3	FeO	MgO	H_2O at 100°	H_2O at over 100°
33.46	12.98	1.60	5.18	.17	33.10	12.94

——Farrington[24] has carefully examined the Arizona *azurites*, on which he finds the new forms $\frac{2}{3}P$, $\frac{4}{7}P$, $3P\frac{3}{2}$ and $\frac{1}{5}^2P\frac{6}{5}$. Four distinct types of crystals are recognized; one is pyramidal with 2P predominant. The others are prismatic, dome-like, and lath-shaped. The latter came from the Longfellow Mine, and are peculiar for their ortho-diagonal elongation and the large development of the ortho-dome $P\bar{\infty}$. The axial relation calculated from the measurements of the different types is $a : b : c = .85676 : 1 : .88603$; $\beta = 87°36'36''$——The very rare mineral *pollucite* has just been reported by Wells[25] as associated with quartz crystals aud clay, and with psilomelane and a nearly colorless calcium beryl at Hebron, Maine. The pollucite is in irregular fragments, perfectly colorless, and as brilliant and transparent as plate glass. Its index of refraction for sodium light is 1.5247, and its density = 2.976–2.985. Its analysis gave:

H_2O	SiO_2	Al_2O_3	CaO	Cs_2O	K_2O	Na_2O	Li_2O
1.50	43.51	16.30	.22	36.10	.48	1.68	.05

corresponding to $H_2R'_4Al_4(SiO_3)_9$, with which formula all the analyses of the Elba mineral may likewise be made to agree.——*Columbite*[26] crystals from the Bob Ingersoll Claim and the Etta Mine in the Black Hills have a tabular habit with $\infty P\bar{\infty}$ predominating.——Snow[27] reports the occurrence of *turquoise* at several ancient workings near Silver City, Grant Co., New Mexico.

[21] Ib., Feb., 1891, p. 105.
[22] *Amer. Geol.*, VII., 1891, p. 181.
[23] *Amer. Jour. Sci.*, April, 1891, p. 296.
[24] Ib., p. 300.
[25] Ib., p. 213.
[26] Blake. Ib., May, 1891, p. 403.
[27] Ib., June, 1891, p. 511.

BOTANY.[1]

The Flora of Chicago.[2]—In this clearly printed catalogue the authors have made a valuable addition to the list of local floras of this country. Very properly the catalogue is prefaced by a brief sketch of Prof. H. H. Babcock, who did so much to make known to the world the peculiarities of the vegetation of Chicago and its vicinity. Then follows an interesting chapter on the geology of the region covered by the catalogue. At the close of the chapter the matter is summed up as follows: "Though Cook county, Illinois, and Lake county, Indiana, have neither mountains nor valleys, no frowning cliffs nor rocky glens, they have an interesting geological history, the outcome of which is a very unique botanical area. The rolling prairies, the river bottoms, the sandy ridges, the lake shore, the drift clay and its ravines, the sloughs among the ridges at the south end of the lake, the peat logs which are found in many places, the shallow ponds and sluggish streams, give a great variety of soil for native plants."

In this area there are catalogued 1,140 species and varieties of native plants, 182 of which have been introduced. The largest order is the Compositæ, with 170 species and 19 varieties. The next in order are: Cyperaceæ, 97 species and 19 varieties; Gramineæ, 85 species and 5 varieties. The largest genus is Carex, with 55 species and 15 varieties. The Pteridophytes have 31 representatives. No attempt is made to enumerate the mosses, liverworts, fungi, etc.

The conformation of the nomenclature to modern ideas, and the uniform "decapitalization" of specific names, will commend this catalogue to the majority of the botanists of the country.—CHARLES E. BESSEY.

The Action of Bacteria on the Rapid Souring of Milk During Thunder Storms.—That milk will sour with unusual rapidity during thunder storms is a theory very commonly held among dairymen, and probably is to a certain extent true. It has been stated by various writers that this is due to an oxidation of the milk by the ozone generated in the air at such times, the oxygen of the air being converted into ozone by the electrical discharges.

[1] Edited by Dr. Charles E. Bessey, University of Nebraska, Lincoln.

[2] **The Flora of Cook County, Illinois, and a Part of Lake County, Indiana. By William K. Higley and Charles S. Raddin. In the Bulletin of the Chicago Academy of Sciences, Vol. II., No. 1, Chicago, 1891.**

This is the conclusion to which two investigators have recently arrived as a result of their experiments.[3] These two, though differing somewhat in methods, arrived at practically the same conclusions,—viz., 1. Ozone will attack milk, and produce lactic acid by a process of direct oxidation; 2. During a thunder storm sufficient ozone is generated by the electrical discharges to exert this oxidizing action on milk.

The method of both these experimenters, in brief, was to expose milk to the action of ozone generated by a spark of electricity passing through oxygen. This was done in a closed vessel, partly filled with milk, and the air above the milk displaced by oxygen; ozone could then be generated by passing a spark across through the oxygen. According to both observers, a spark passed in this way from fifteen to twenty minutes would generate enough ozone to coagulate the milk in less than an hour. According to Prof. Tolomei, this action is even more rapid if, instead of a spark, a "silent discharge" of electricity from the two poles of the battery be employed. This is due simply to the fact that a larger amount of ozone can be generated from a given quantity of oxygen by the "silent discharge" than by a spark.

These results differ considerably from some obtained in this laboratory some time ago. Since the publication of Tolomei's work ours has been repeated, and gives exactly the same results as were obtained before.

Our methods were similar to those described above. A Wolff bottle was taken and filled with milk and oxygen. Wires connected with a Holtz induction machine were then passed in at the opposite necks of the bottle, and ozone generated by passing electricity, either as a spark or in the form of a silent discharge, across through the oxygen. A second bottle was partly filled with milk and kept as a control.

Although repeated over and over, under various conditions of temperature, and with milk of various degrees of sweetness, from that just from the cow to that a day or more old, in no case were we able to produce any such rapid souring as was described by Iles and Tolomei. We did, however, get a slight hastening of the time of souring. If the control coagulated in thirty-six hours, that experimented on would coagulate only an hour or two earlier. Moreover, we found that free oxygen alone was sufficient to produce this slight hastening.

[3] D. W. Iles, *Chemical News*, Vol. 36, p. 237, 1877. Prof. Tolomei, *Biedermann's Centralblatt für Agriculturchemie*, 1890, p. 538.

A further experiment showed that if the milk used be *sterilized* before it is treated with oxygen and ozone, and is then protected from contact with unfiltered air, no coagulation occurs, no matter how much oxygen is introduced. We have subjected sterilized milk to the action of the electric spark for over an hour, and then kept this milk in our laboratory two months, without the appearance of the least sign of coagulation.

From the fact that only a slight hastening of the time of souring resulted in the case of ordinary milk, and that no coagulation at all was produced if the milk were sterilized, we conclude that the process cannot be one of oxidation, but is due rather to the rapid growth of the bacteria of the milk under the influence of the free oxygen, and, possibly, to a certain extent, of the ozone also.

It is possible that during a thunder storm a sufficient amount of ozone may be generated to stimulate the bacteria and bring on a rapid souring. It seems very improbable, however, that the small amount of ozone usually produced at such a time could have any such effect.

The true cause, it seems to us, is to be found in the warm, sultry atmosphere which usually precedes and accompanies these storms. These atmospheric conditions, as is well known, are especially favorable to the growth of bacteria, and this rapid growth brings on a correspondingly rapid souring of the milk.

These are, in brief, the conclusions at which we have arrived from the results of our experiments. They are, to a certain extent, borne out by the experience of the proprietor of a neighboring creamery. He finds that if milk be kept at a uniformly low temperature, no trouble results from souring during the thunder-storm season.

It will be seen from the above that ozone, at least in the small amount (about five per cent.) which can be generated from a given amount of oxygen by the electric spark, is not destructive to the bacteria which causes the souring of milk. This fact is of interest, in view of the common use of ozone as a disinfectant.—AARON L. TREADWELL, *Biological Laboratory, Wesleyan University.*

The Parry Herbarium.—This important collection of plants has been carefully arranged and catalogued, and is now offered for sale by Mrs. E. R. Parry, the widow of Dr. Parry. It is particularly rich in western and southwestern species. The whole number of determined specimens is eighteen thousand, representing 6,780 species. By far the greater portion of the species are North American, but seven hundred being natives of other parts of the world. It is to be

hoped that this herbarium will come into the possession of some institution which will make it accessible to the botanists of the country.

Palmer's Mexican and Arizona Plants of 1890.—The plants collected by Dr. Edward Palmer during the year 1890 have been determined by Mr. J. N. Rose, of the National Herbarium, whose report has just appeared as one of the "Contributions." A good many new species are described, one of the most interesting of which is *Echinopepon cirrhopedunculatus*, a near relative of our familiar *Echinocystis lobata*. In the new species the female flowers are borne upon slender, coiled, tendril-like peduncles, from three to six inches in length. Apparently we have here a hint as to the morphology of the tendrils of the Cucurbitaceæ. This would indicate their cauline nature.

Three Months of Elementary Botany.—By setting the student at work collecting green-slimes, pond-scums, smuts, leaf-spots, toad-stools, lichens, scouring rushes, together with flowering plants, many kinds of vegetable forms are presented to him, and their resemblances or differences readily impress themselves upon his mind. This discursive collecting is not so symmetrical or simple as the ordinary selective method which rejects anything without a flower at least half an inch in diameter. It is calculated however, to give a more just idea of the plant world as a whole. With reference to structure, much more can be seen with the unaided eye than teachers suppose. For example, a thin slice of squash stem held up to the light shows clearly enough the subepidermal tissues and the bicollateral structure of the vascular bundles. A vast amount of dissecting and anatomical work can be done with pins and pocket-knives. If rightly used, the eye is a splendid microscope, but one must use it with the "fine adjustment." Even things which it is fashionable to slight may become productive under proper handling. Phyllotaxy—that much abused and ridiculed section of anatomy and physiology—presents admirable fields of study in the mechanics of development. Close examination of the shoot-epidermis opens up almost every division of physiology. For the epidermal system is specialized for defence, nutrition, growth, irritability, attraction—sometimes—of insects, and, with its color, texture, thickness, extent, perforations, projections, secretions, is a most convenient and instructive object of attention in a three-months' course of botany. In connection with such work in morphology and physiology, the structure of flowers, the physiology of reproduction, the principles of classification may be

studied. The demonstrations—by the developmental chain from the lower to the highest plants—that the pollen plant is itself an independent plant, is instructive.

Let us see what the method of presentation should be in the department of plant physiology. In its modern aspect, this is rather the newest field of botanical investigation. It is commonly supposed to be quite beyond the resources of an ordinary equipment, and is mentally associated with regiments of flasks, brigades of induction-coils, and whole armies of expensive and delicate pieces of apparatus. Certainly all the resources of chemistry, physics, and mechanics may be brought to bear upon the science of botany, and the result is our present mechanical or physico-chemical theory of plant life. But, although one may conduct experiments of great delicacy, it is scarcely imperative, on that account, for the teacher trying to give an evenly balanced six fortnights of botany to present such experiments. The truth is, one may do most of the physiological experiments without apparatus. Seedlings planted in little boxes which may be set on edge illustrate geotropic curvatures; others set in the window illustrate the heliotropic position. To etiolate a plant needs but an empty flower-pot turned over it. Tissue tensions are illustrated by slicing a radish or parsnip and soaking awhile in water. Tendrils may be stimulated to curvature, bladderworts and pitcher-plants may be grown for examination, leaves may be covered with felt pads to illustrate the transitional movements of the chorophyl bodies within; the phenomena of wilting, artificial culture solutions, fermentation, temperature changes in germinated seeds, and a hundred others are demonstrated without difficulty.

For such a course there is no text-book. The teacher must give it by brief lectures, or better, by occasional dictations. Some such compilations as Dr. Goodale's "Physiological Botany," or "Vine's Lectures on Plant Physiology," may be used for reference. Pfeffer and Detmer are the best authors for those who read German, and Frank's little books are admirable. By such a course, brief though it may be, the student will learn that there is not a position of a leaf, not a coil in the tendril, which has not its sufficient cause. Thus he will learn in proper fashion what is meant by scientific investigation.

It may be urged, and not without reason, that such courses as have been briefly outlined are too extended for the time allotted them. Such is not the case, however, for such courses are practical, as is shown by their adoption in more than one college and academy in America. Students should not be persistently underrated. Even

the dull ones will be able to radiate a little light of their own if opportunity is given them to do something more than repeat the feeble beams of a text-book. And this is the greatly needed thing; this is the essential thing,—that students should think for themselves. Original thought is the spirit of the present, the genius of the future. A rational course of study is the alembic which can precipitate such thought from a solution of confused and half-formed notions. Science itself is to be defined as that mass of facts within experience by which we criticize our primitive ideas. Therefore, everything should be bent to bringing forth true thought from the pupil; otherwise he cannot arrive at intellectual manhood.—CONWAY MCMILLAN, *in Education.*

ZOOLOGY.

The Anatomy of Phagocata.—Woodworth's paper[1] on the structure of this Triclad is a valuable contribution to our knowledge of the Turbellaria. This worm, described by Leidy forty years ago, has been neglected until now. Woodworth has investigated the anatomy in a thorough manner, and besides confirming Leidy's account of the many pharynges—doubted by several helminthologists—has investigated all parts of the animal. Phagocata possesses a main pharynx which opens at the junction of the three branches of the alimentary tract, and, besides, many others which open into the posterior trunks of the intestine. These are arranged without apparent order, except that the further they are from the median pharynx the smaller they become. The development of the rhabdites is traced. They arise in gland cells lying in the mesenchyme, and pass up into the hypodermis, where they have an intercellular position, by means of tubular projections of the mother cells. Woodworth thinks the function of the rhabdites to be to aid in the capture of prey, since by their slow solution in water they form a thick mucus. The body of the animal is usually darkly pigmented, the pigment being scattered granules intercellular in position. In its nervous system Phagocata stands intermediate between Gunda and Rhynchodesmus. There is a superficial and a deeper portion, the two being indirectly connected by means of a marginal nerve. The vasa efferentia are products of the testes; and the growth of the yolk glands

[1] Bull. Mus. Comp. Zool., XXI., No. 1, 1891.

shows that these and the ovaria are formed by differentiation from a common anlage. The pseudocœle spaces in the parenchyma are intercellular.

Crustacea and Echinoderms of Japan.—Mr. J. E. Ives has recently studied[2] the collections made by Mr. Frederick Stearns in Japan. The novelties described are: *Pectinura stearnsii, Cryptodromia stearnsii,* and *Ascorhyncleus japonicus.*

The Affinities of the Molluscs.—Thiele has done some good word in the anatomy of the Mollusca, and hence his recent paper[3] is a surprise. Thiele not only considers the phylogenetic relationship of the molluscs, but of most of the invertebrates as well. Space is available but for a few samples of his conclusions. The lowest Ctenophores stand lower than all other Cœlenterates and nearest to the primitive metazoan. From them with "kaüm ein Zweifel," the sponges "ohne Schwierigkeit" are to be derived, the apical pores of the Ctenophore giving rise to the pores of the sponge! So, too, from them come the Cnidaria and the bilateral animals. In the group of molluscs, derived from the Plathelminthes, some peculiar "homologies" are recognized. Thus the operculum of many Gasteropods is the homologue of the posterior element of the chiton shell. The Trochophore is homologized, bit by bit, with the Ctenophore, etc., etc. The whole is supported by an idea of "centralization" which, in its application, is carried to the same extreme as was a few years ago the principle of "cephalization" advanced by an American author, and which receives its deathblow in the same group (the Crustacea) in which it was supposed to receive its strongest confirmation.

The Head of Elasmobranchs.—Miss Julia B. Platt continues[4] her studies of the vertebrate head, to which reference has already been made in our pages. She shows that in Acanthias the alimentary canal at first extends forward beyond the neural plate to the anterior extremity of the embryo, and later the anterior portion of the entoderm is separated from the rest by the downward growth of the infundibulum. There is evidence which goes to show that the notochord formerly extended to the anterior end of the entoderm. From the anterior entoderm arise the anterior head-cavities, and a second pair of cavities in front of the mouth are formed by cells proliferated from the dorsal ento-

[2] Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 210.

[3] *Jenaische Zeitschrift,* XXV., p. 480, 1891.

[4] *Anatom. Anzeiger,* VI., p. 251, 1891.

derm. These cavities have at early stages a nerve supply in which both motor and sensory roots occur; one nerve, called the "thalamicus," being apparently a new discovery, and is probably to be regarded as the dorsal root of the oculomotorius.

The Reproduction of the Conger.—Mr. T. J. Cunningham thinks[5] that the conger eel reproduces but once in a lifetime, and then dies. He gives many facts, new and collected, to support this view, although he has never obtained ripe eggs. The female increases in size towards the period of maturity, and this growth, sometimes so excessive as to burst the body open, is the result of the enlargement of the ovaries. During some months before maturity both male and female congers refuse all food, and all reserves stored up in the body are transferred to the reproductive organs. This process goes so far that the teeth are lost, while the bones of the skull lose all osseous characters and cut like cheese. From various facts Cunningham reasons that the eggs of the conger are pelagic and transparent, and he attempts to identify certain unknown eggs from Naples with several Murænoid fishes.

A New Species of Frog from New Jersey.—It is well known that the coastal plain of New Jersey is both zoologically and botanically very different from the Piedmont regions, and that its species have a greater or less distribution in the corresponding region of the states to the southwest of it. Among fishes, the few species of the Percid genera Acantharchus and Enneacanthus range through the entire coastal region, with the *Etheostoma barrattii*. The *Mesogonistius chætodon* covers so far, only New Jersey and the Chesapeake peninsula, while the *Lepomis phenax* has not yet been found south of New Jersey. Among Batrachia a marked instance of this distribution is furnished by the *Hyla andersonii*, which has been found at two localities in New Jersey and one in South Carolina. I have now to add to this list a species of Rana found in Southern New Jersey, which has hitherto escaped detection. It is a most distinct one, and about the size of the wood frog (*Rana silvatica*).

RANA VIRGATIPES, sp. nov.—Vomerine tooth patches between the choanæ, and extending posteriorly to their posterior border. Hind legs short, the heel extending from the middle of the tympanum in some to near the eye in other specimens. Webs rather short, two phalanges of the fourth toe free. Præhallux small, but quite promi-

[5] Jour. Marine Biol. Assn. United Kingdom, II., p. 16, 1891.

nent; no external solar tubercle. Skin of upper surfaces of body and posterior limb covered with minute tubercles; no longitudinal dermal folds. Males with, females without, external vocal vesicles. Interocular width one-half that of each eyelid. Tympanic disk distinct, equaling the eye in longest diameter. Head (to posterior border of tympanic disk) about one-third length of head and body. End of muzzle oval-acuminate, projecting moderately beyond mouth border. Nostril opening vertically equidistant between border of orbit and end of muzzle. First and second fingers subequal and longer than the fourth.

The color of the upper surfaces is an olive-brown, varying to more or less yellowish or blackish. Two light-brown longitudinal bands on each side, one commencing at the orbit and extending above the tympanum to the sacrum or beyond it; the other commencing at the muzzle, involving the upper lip, and extending to the groin. The dark color of the top of the muzzle contrasts strongly with the lighter color of the upper lip, at the canthus rostralis. The inferior band is bounded below from the axilla to the groin by a wide black band, which is made up of several more or less confluent spots. Inferior surface of head and body white; the former dusted with blackish in both sexes, the latter with or without blackish blotches. Fore limbs brown above, black on anterior and posterior faces, and white, with blackish blotches, below. Hind limbs brown on upper surfaces, with two or three black blotches on the femur and tibia. Remainder of hind limb and foot black, with the following exceptions: A light-yellow band commences at the groin and extends along the femur, passing under the knee to and along the external border of the tibia and the anterior face of the foot. It expands here, and extends on the anterior surfaces of the first, second, and third digits. A subtriangular white blotch occupies the middle of the inferior surface of each femur, meets its fellow, and sometimes connects with the white of the belly on the middle line. A narrow, horizontal white line, generally broken into spots, divides the black of the posterior face of the femur. Inner edge of tibia with some white spots.

Length of head and body, 60 mm.; width of head at posterior borders of tympana, 21.5 mm.; length of fore limb from axilla, 28 mm.; length of hind limb from vent, 76 mm.; length of hind foot, 39 mm.; of tarsus, 15 mm.; of tibia, 23 mm.

This frog is not nearly related to any species of the genus. It has some points of resemblance to the *R. temporaria*, as the short posterior legs and moderate web; but the interocular space is much narrower,

the vomerine teeth more anteriorly placed, and there are no dermal folds. In coloration there is no resemblance to any other species.

I obtained five adult and two half-grown individuals, and had two other adults almost within my grasp, but they escaped me. The specimens agree nearly in size, the chief differences being observed in the amount of dark blotching of the belly and the regularity of the markings on the inferior side of the femur. The specimens were found in a cut-off of a tributary of the Great Egg Harbor, River in Atlantic county, New Jersey. The water is stagnant, and is well grown with Nymphæas, Utricularia, and Sphagnum. The frogs did not display any considerable powers of leaping or swimming, but concealed themselves with much ease within the aquatic vegetation. I did not observe any voice. In the same locality I observed the *Ranæ virescens* and *clamata*. The cut-off is in the woods, and I found no individuals in similar situations in the open country, nor any along running water in the woods.

The oversight of this conspicuous species is a curious circumstance. —E. D. Cope.

Zoological Notes.—General. — Dr. A. Voeltzkow has been giving[6] a general résumé of fresh-water fauna of Madagascar. The present paper gives promise of many interesting facts when the completed paper appears, both of new forms and of geographical relationships.——Frenzel describes,[7] without naming, an interesting infusore from a salt-water aquarium in Argentina. It is saccular, pointed at either end, and depressed so that it may be called bilateral, the ventral surface being flattened, the back rounded. The lower surface is ciliated, the dorsal with a few short bristles. In front is a mouth, posteriorly an anus, the mouth being surrounded by strong cirri. The wall of this organism is composed of a single layer of cubical cells, bounding the "alimentary canal." Reproduction takes place in two ways: (1) by transverse fission, and (2) by conjugation and subsequent encystment. Two individuals oppose the ventral surfaces, and contract into a sphere which secretes a cyst. The internal processes were not clearly observed; it appears that the alimentary lumen is filled by cell division, so that the whole cyst is filled with similar cells, each of which is to be regarded as a spore which, after liberation, swims about as a ciliate, and by cell division develops directly into the adult. No hints are given as to the relationships of this form.——Mr. F. A. Lucas describes[8]

[6] *Zool. Anzeiger*, XIV., 1891.

[7] *Zool. Anz.*, XIV., p. 230, 1891.

[8] Proc. U. S. Nat. Mus., XIV., p. 169, 1891.

several points in the structure of the humming-bird's tongue. This organ is tubular, but as it lacks any pumping apparatus it can take fluids only by capillary attraction. Lucas thinks it is rather an instrument for the capture of small insects, a view supported by the size of the salivary glands.——*Tetraprion jordani* is the name of a new tree toad from Ecuador described [9] by Dr. L. Stejneger and Mr. F. C. Test. It differs from all other Hylidæ in the presence of palatine teeth.——A recent paper by Barton A. Bean [10] on the fishes of the Chesapeake is interesting from its richness in local names. Thus, the file-fish is locally called fool-fish; the flounder (*Paralichthys dentatus*) is the chicken halibut; the toad-fish, bull-fish; *Stromateus paru*, butter-fish; the weakfish as trout or gray trout; scup is maiden; the sea-bass is black will or black nell; the blue-fish is tailor; the menhaden is old wife, etc.

EMBRYOLOGY.[1]

Embryology of the Sea Bass.—Dr. H. V. Wilson has published in the bulletin of the United States Fish Commission for 1889, Vol. IX., a contribution to the embryolgy of *Serranus atrarius* in particular, and teleostean embryology in general. The paper covers sixty-eight pages of text, and is accompanied by twenty photo-lithographic plates. Dr. Wilson has given a most excellent account of the development of a single fish, from the egg to the time when the young fish hatches. To those desiring a simple and straightforward account of fish development, brought up to date, the present contribution will meet every want. As a contribution of original research the different parts are of different values. For instance, while the sections on gastrulation, concrescence, and the formation of the lateral line are valuable, and largely, more especially the last, original contributions to modern embryology, yet the sections dealing with the central nervous system, blood vessels, notochord, gill-slits, anterior body-cavities, etc., are by no means so fully treated, and little addition is made to our present knowledge. This, perhaps, is a necessity of the attempt to cover so large and so well worked a field; indeed, one of the most prominent facts brought out in the paper is that the grounds seem so

[9] Proc. U. S. Nat. Mus., XIV., p. 167, 1891.

[10] Proc. U. S. Nat. Mus., XIV., p. 83, 1891.

[1] Edited by Dr. T. H. Morgan, Johns Hopkins University, Baltimore.

thoroughly to have been covered by previous writers, and the author attempts to show in the fairest manner possible which of the (always) several accounts is the more probable from his "observations on the bass." We may now pass critically over the different sections of the paper.

The egg of the sea bass is a small pelagic egg, about one mm. in diameter. Imbedded in the yolk, but near the surface, is a single large oil globule, which is always uppermost in the floating egg. After fertilization the protoplasm, which heretofore formed a thin layer over the egg, begins to flow to the pole opposite to the oil globule (lower). This patch of protoplasm at the lower pole is at first circular. Just before or during the first act of cleavage there arises an inequality in the axes, so that by the time the first two blastomeres are marked off the germ is bilateral. In the bass and mackerel the first two blastomeres are of equal size. "This is normally so with the cod as well; but on one occasion I observed that in all the eggs got from a single codfish the first two blastomeres were unequal in size. The inequality was very marked; but the eggs were healthy and the average percentage of fish was hatched out."

This observation, which the author does not further follow up, must have an important bearing on the relationship of the first cleavage furrow to the plane of the adult body, and hence on the problem of the quantitative relationships of protoplasm (and nucleus?) in cell division. The somewhat hasty generalization, that in the Triploblastica the first cleavage plane divided the egg into right and left halves with reference to the adult, is meeting with general and inexplicable exceptions; and it is the exceptions determined by casual observation as the above that show clearly that we do not yet understand the relationship between egg cleavage and adult structures.

"The teleostean segmentation [cleavage of the egg] has undoubtedly been derived from a total segmentation essentially like that of Amphibia; and convinced of this, Rauber, Agassiz and Whitman, and Ziegler have endeavored to homologize the early furrows in the two groups. In regard to the first two furrows there can no be difference of opinion. The homology of the third teleostean furrow is by no means so clear. Ziegler, without entering into a detailed discussion of the matter, regards the first three furrows in the two groups as homologous. Agassiz and Whitman, after a critical examination of Rauber's views, also pronounce in favor of this homology, deciding that the third teleostean furrow represents the equatorial furrow of Amphibia. I do not find, however, their reasons sufficient for discarding the homology offered by Rauber, supported as it is by variations (atavistic) in the teleostean germ toward

the amphibian segmentation which so exactly imitate the teleostean types. . . . . According to Rauber, the first equatorial furrow of the frog has been lost in the Teleost. Agassiz and Whitman would seem to believe that the *a priori* improbability of such a loss taking place is so great that, in spite of the variations just described, it is preferable to regard the first three furrows as homologous in the two groups. I do not see the inherent improbability of the loss. On the contrary, the disappearance of segmentation in the ventral half of the egg, coupled with the early contraction of the protoplasm (belonging to this half) towards the upper pole, make it easy, I think, to understand how the loss was brought about." The author seems to have come to this conclusion largely on account of the close resemblance in the arrangement of the eight micromeres in the 16-celled frog's egg with the eight-celled stage in the bass; but inasmuch as there exist the greatest individual differences in the arrangement of the micromeres in the frog, and also in the fish, we have every reason to believe such a general resemblance might have been independently acquired in each case, and that the eight-celled stage in the fish corresponds to the 16-celled stage in the frog; and that the resemblance between the 16-celled stage (eight micromeres, eight macromeres) in the frog and the eight-celled in the fish is entirely superficial. Moreover, if, as the author attempts to show, the fish gastrula may by derived directly from the frog's gastrula, we have every reason to believe that so fundamental a process as the cleavage stages must be similar, making a very strong "*a priori* improbability" that the third furrow of the frog has dropped out of the fish egg.

As is well known, the eight-celled stage of the frog separates in general the micromere cells of the upper (anterior?) pole from the lower cells containing more yolk. Now if the view taken by Agassiz and Whitman be true, it would seem probable that in the eight-celled stage of the fish four (most probably the more central four) cells would be entirely cut off from the protoplasm covering the yolk, and that the other four cells would have their protoplasm continuous, in part at least, with the protoplasm covering the yolk. To some extent the author's figures bear out such an interpretation, although he does not seem to have examined the sections from such a point of view.

The origin of the periblast in the bass is the same as is described in Ctenolabrus by Agassiz and Whitman. "These authors proved beyond a doubt that in Ctenolabrus the nuclei are derived from the marginal cells of the blastodisc, which from the earliest stages of segmentation are connected with the yolk or periblastic protoplasm." (See above.)

The whole of the periphery of the blastoderm turns in, forming a layer between the periblast and the superficial ectoderm of the animal pole. The invaginated layer from the posterior pole gives rise to the mesoblast and notochord by delamination, and the remaining cells go to form the midgut, the periblast taking no part whatever in the latter structure, but remaining encircling the yolk, and ultimately assisting to digest it when it begins to disappear by absorption by the liver cells. The blastodermic cap grows over the yolk. "As the blastopore grows smaller, the extra embryonic part of the germ-ring is *pari passu* drawn into the tail end of the embryo, and there is thus built up in this region a constantly increasing wall of undifferentiated cells. . . . In the bass there is no actual concrescence in the middle line; but the terminal notch observed in some fish, as well as the general considerations derived from a comparison of Teleost with Amphibia, warrant us in regarding the closure of the blastopore as a process of concrescence, the result of which is to establish the primitive streak. The entire mass of undifferentiated cells left at the tail of the embryo after the blastopore closes serves as a cellular material for the backward growth of the several organs. Thus, while the extra embryonic germ-ring, as has been insisted upon by Agassiz and Whitman, and Cunningham, assuredly forms part of the embryo, it does not form any special part; but, on the contrary, its cells eventually find their way into ectodermic, mesodermic, and notochordal tissues" of the tail. In other words, the author believes the two halves of the trunk of the embryo are not formed by concrescence of the blastopore, mesoderm, or any modification of it, but that all of the mesoderm turned in around the rim (except at the post-embryonic pole) accumulates at the upper ridge of the blastopore (in the caudal mass) and at its sides, and this latter differentiates into the mesoderm and its products in the tail.

"The alimentary canal is formed from the simple endoderm lamella [invaginated endoderm without the parablast] by a process of folding along the median line. The fold is converted into a tube by the meeting of its lower edges. There is a solid postanal gut formed as a thickening of the endoderm lamella, not as a fold. At the end of the postanal gut is Kupffer's vesicle, which is formed in essentially the same way as the permanent alimentary tube. It is scarcely necessary to say that Kupffer's vesicle and the entire post-anal gut [subsequently] atrophy." "The discovery of this vesicle was made by Kupffer in

1868, and since then it has occupied a conspicuous place in the embryology of Teleosts. . . . The alimentary canal is formed by a process of folding, and Kupffer's vescicle, as the terminal part of the postanal gut, follows the same method. After the gut has once been folded off, the homology of the vesicle with the postanal vesicle of Selachians is obvious. In each group the vesicle forms the dilated extremity of the postanal gut, and receives, or would receive if it existed, the neurenteric canal. . . . But if Kupffer's vesicle in its early stages indicates that the terminal portion of the archenteron was primitively dilated, we naturally inquire both for the causes and for a corresponding phenomenon in the ontogeny of those ainmals in which the archenteron is bodily transformed into the permanent gut. As to the latter point it would seem very common in the Amphibia for the archenteron to be thus dilated. The existence of such a dilatation in the enteron of the primitive Chordata is further made probable by, and receives an explanation from, the relation of the neurenteric canal to the blastopore. It will be seen that in the interpretation of Kupffer's vesicle I substantially agree with Cunningham: it is the terminal part of the archenteron."

The most interesting addition to our knowledge is the author's discovery that the ear, branchial sense-organs, and organs of the lateral line arise from a common structure or embryonic "anlage." "It has been noticed in the trout that the anlage which was supposed to develop into the ear is remarkably long. I have found that this anlage not only gives rise to the ear, but to a functional branchial sense-organ and to the organs of the lateral line as well. Before the blastopore closes there is found behind the eye a long, shallow furrow [the sensory furrow] in the nervous layer of the ectoderm. At two points the furrow begins to deepen, the deepening taking place downwards and inwards. At these two points the auditory sac and the branchial sense-organs will respectively be formed. . . . A further stage in the development shows that the deepening of the furrow in the auditory and branchial sense-organ regions has continued until there are are two well-marked sacs, the anterior of which is the branchial sense-organ, the posterior the auditory sac. Between the two sacs persists the connecting portion of the sensory furrow, and behind the auditory sacs the furrow is continued for some distance. *The posterior portion of the furrow constitutes the anlage of the lateral line.*

"The homology instituted by Eisig between the lateral line organs of fishes and the 'seiten organ' of certain Annelids is well known. Balfour, in his text-book, declined to accept it; and though Beard

favored the homology in his paper on the teleostean lateral line, after studying the Selachians he gave it up. Now that the early development of the lateral line is approximately known in Teleosts and Selachians, there seems less than ever to be said for the homology. If it could be shown that the segmental sense-organs of Annelids, leeches, etc., arise from an anterior anlage, which grows and, so to speak, distributes the sense-organs along the trunk, the homology might well be supported. But as far as I know the invertebrate segmental organs arise *in situ*."

"The fact that there is in the bass a common anlage for the ear, branchial sense-organ, and lateral line has certainly no phylogenetic significance. It can only be regarded as a convenient method of forming these sense-organs which the embryos of certain animals have adopted. It, however, serves to emphasize in a striking way the serial homology between the organs which previous work has already made so probable." The interpretation of this latter quotation is somewhat obscure and the author's meaning difficult to read betweeen the lines. If he means that the ear, branchial sense-organs, and lateral line have arisen in the adult in the same position found in the adult to-day, and have subsequently concentrated in the embryo into a single anlage, he brings no evidence forward to support his position. If he means that in the adult these three sets of organs arose from a single anterior organ, and the ontogenetic phases repeat the ancestral process, then the theory seems in better accord with the facts, but his words seem to bear out no such interpretation. At any rate, to announce that in their origin, which he has himself discovered, there is no "phylogenetic significance" seems an extremely hazardous affirmation. In any case, however, the discovery itself is extremely important, and may have an important bearing upon the question of metamerization of the vertebrate as contrasted with that of the Annelid.

The last section deals with "General Morphological Questions," touching mainly upon concrescence and the interpretation of the process of gastrulation in the Teleost. "In the growth of the blastoderm around the yolk, the head end of the embryo does not remain a fixed point, as His supposed. On the contrary, the tail end of the embryo (posterior pole of the blastoderm) remains a comparatively fixed point, as Oellacher first showed, while the anterior pole of the blastoderm travels rapidly around the yolk. The point where the blastopore closes is thus but a short distance from the original position occupied by the posterior pole of the blastoderm. Owing to the constant position of the single oil globule, these facts can easily be

made out." This argument itself is vitiated in the assumption of a fixed point for the oil globule, as the author gives little reason for believing that the latter may not change position with the growth of the embryo. Moreover, and this is much more important, the author's conception as to the position of the frog's gastrula in relation to the poles of the embryo may not be correct, and must seriously alter his conception of the position of the fish embryo to the egg if he insists on a strict comparison of the two forms. (See below.)

The author's conception of gastrulation in the fish may be gathered from the following quotation: "Accepting Ziegler's homologies, it will be seen that the whole course of the fish development becomes easy to understand. Starting with the blastula, and disregarding for the present the non-embryonic part of the germ-ring, the primitive hypoblast corresponds to the primitive hypoblast which invaginates around the dorsal lip of the blastopore in the frog gastrula. The chief point of difference is the lack of continuity in the fish embryo between the inner edge of the invaginated layer, and the yolk is easily explained as an adaptation to the method of forming the alimentary canal from the invaginated layer exclusively. The archenteron lies between the primitive hypoblast and the periblast. In consequence of the absence of continuity between the yolk and the invaginated layer, the archenteron at its edge is not separated from the segmentation cavity *The growth of the anterior pole of the blastoderm around the yolk represents the growth of small cells around the yolk-cells in amphibian gastrulation.* The closure of the blastopore takes place in the same way as in the Amphibia; there is formed a short primitive streak behind the position of the neurenteric canal (Kupffer's vesicle in Teleosts); at the posterior end of the primitive streak the final closure takes place. . . . The asymmetry which Balfour showed to be a characteristic attribute of vertebrate gastrulation is present in the highest degree in the Teleost gastrula. At the posterior pole of the blastoderm (dorsal lip of blastopore) there is an extensive invagination which gives rise to the roof of the archenteron. The cause of the asymmetry must be looked for in the peculiarly localized distribution of the yolk in the egg."

The italics above are my own, and emphasize the fact that the author does not realize that in the gastrulation of the Amphibia, to which he so constantly refers, the anterior pole does not grow over the yolk in an epibolic fashion, but that the anterior (black) extension of the blastoderm over the yolk takes place by a delamination of ectoderm cells from the large yolk-containing cells (see AM. NAT., Embryology, August, 1891). This latter view has been recognized by Kupffer and

Hertwig. "Now the growth of the blastoderm over the yolk does not take place, according to Kupffer, in a true epibolic fashion, but is accomplished through the medium of a zone of tissue in which the yolk-cells become transformed into the cells of the two primary layers. Hertwig holds the same opinion. If this be really the case in Amniota, two explanations of the process are possible: First, that it is a modification of the ancestral, epibolic growth, such as occurs in Teleosts, which view Kupffer and Hertwig would of course reject, because it is equivalent to admitting the homology of the blastoderm edge in Teleosts and Amniotes, and consequently the correctness of the Balfour-Rauber hypothesis; secondly, that the process is, to refer it to simple embryonic forms, one of progressive delamination. It will be seen that Kupffer's hypothesis really implies the occurrence of the latter process, for when he explains the spreading of the blastoderm as the completion of the blastula stage he really means that the embryo splits off ectoderm progressively from *a* to a^1 towards *m* (anterior embryonic portion). Thus, again, to refer the processes to their simplest forms, over one half of the blastula (yolk half) delamination occurs; but in the other half there is a true invagination (region of prostomia and primitive streak). . . . However, the analysis I have given is, I think, a perfectly fair one, and the result is evidently prejudicial to their theory. For the conclusion is that the Amniotic vertebrates have a blastula which invaginates over one half and delaminates over the other. Such an embryonic form is nowhere known to occur, and the theory which is forced to assume its existence is in so far a weak theory, and must give place to any other which can explain the facts by making use only of known processes." Unfortunately for the author, the weak theory is probably to be regarded as a real fact, and if so the author's argument collapses. Whether or not a readjustment of the author's views may show him to be largely in the right, is another question for the future to settle. Meanwhile any conception of fish (and Amniote) gastrulation must take into account as a starting point the delamination over the anterior and ventral face of the early stages of the frog's development.—T. H. M., *September 9th, 1891.*

The Development of Hydra.[2]—The ground already covered by Kleinenberg ('72), Kerscher ('89), and Korotneff ('83) has again been worked over by Dr. August Brauer. The following species of brown ("not green") hydras were studied: *H. grisea.* Eggs and

[2] *Zeit. Wissen. Zool.*, Bd. 51, Heft. 2, 1891.

spermatozoa. May, June, and July. Bisexual. The eggs fall off from the mother as soon as the outer coat of the embryo is formed. The embryos do not hatch for one or two months. *H. fusca.* Eggs mature in October. Bisexual. The eggs do not fall off, but are stuck to surrounding objects by means of a jelly, and flatten down somewhat on the support. Probably the eggs are deposited in different places. The time between egg-laying and hatching is as in the last species. *H. sp. ?* Adult resembles closely *H. fusca.* More than half of the individuals kept in the aquarium developed into males alone, and later after the disappearance of the testes they did not develop eggs, but continued to bud. The remaining individuals developed into females. The eggs remain attached to the mother. When all of the eggs have developed as far as the two-layered stage the mother contracts strongly her body down to the base. The eggs come to lie around the base of the mother, remaining sticking to her. The mother remains in this strongly contracted condition for several weeks, and the embryos often escape from the shell before the parent again extrudes. Three embryos hatched in one case fourteen days after the contraction had taken place.

The author suggests that the adult species may be identified in the form of the eggs and the structure of the egg-case:

1. *Hydra viridis.* Egg falls off. Form spherical. Case smooth.
2. *Hydra grisea.* Eggs fall off. Form spherical. Case covered with large and often branched spines.
3. *Hydra fusca.* Eggs singly stuck to objects. Form below, flat; above, convex. Case covered with spines only on the upper surface.
4. *Hydra sp. ?* Eggs (at base of mother) generally all stuck at one place. Form spherical. Case covered with short spines.

The maturation and fertilization of the egg is described in much greater detail than ever before. The egg begins to round up, drawing in the protoplasmic processes, but still remaining beneath the ectoderm. At this stage the *two* polar bodies are extruded. The egg later breaks through the overlying ectoderm, but remains attached by a broad base. Fertilization then takes place.

The eccentric position of the segmentation nucleus causes the first furrow to begin at the distal pole (away from the mother), and then, after many changes in the outline of the egg, the yolk follows the nuclear division, and moreover, *in the same way as Bergh*[3] *describes in Gonothyræa,—viz., the nucleus divides a second time, and the second*

[3] *Morph. Jahrbuch*, Vol. V., 1879.

furrow is visible while the first furrow has not finished.[4] With the passing of the furrows through the egg the nuclei pass to the middle. If they have reached this after the end of the second cleavage, then the segmentation proceeds more rapidly and regularly.

A blastula stage follows, and from it the endoderm is formed at all points over the surface, by both delamination (Theilung) and migration (Einwanderung). Later the blastula cavity is filled with solid endoderm. From the ectoderm the outer chitinous case is secreted, and later the inner germ-membrane. The ectoderm remains intact, and goes over into that of the adult. The sequence of the appearance of the tentacles does not follow any defined law. The mouth-pole is in all probability identical with the pole that gave rise to the polar bodies.

Morphology of the Vertebrate Head.[5]—In the *Anatomischer Anzeiger* (VI. Jahr., '91) Julia B. Platt publishes a contribution of the "work presented last October for publication in the *Journal of Morphology*." The present paper deals with the origin of the head segments and their nerve supply. "The anterior limit of the fusion of the edges of the neural plate is therefore not the neuropore, but the anlage of the optic stalk. . . . The optic nerve which later develops into the optic stalk is therefore primarily a dorsal structure, and morphologically the first or most anterior of the cranial nerves. Anterior to the first gill-cleft, Acanthias has therefore seven pairs of somites,—three for the hyoid arch, two for the mandibular, one premandibular, and one 'anterior.'"

In the Teleost Batrachus the author says: "My study of the development of the mouth in Batrachus but confirms the work published many years ago by Dohrn on the development and significance of the teleostean mouth. At an early stage a pair of pockets from the alimentary canal open to the exterior anterior to the hyomandibular clefts. Much later in the development of the embryo the mouth *breaks through in the ventral region* of these pockets as a bilateral involution of the ectoderm, fusing with the endoderm, and opening to each side of a central partition sometimes before the median line is

[4] The italics above are my own. The relation between the cleavage of the protoplasm and the division of the nucleus is a parallel case to that observed by Mayer in Pagurus and by E. B. Wilson in Renilla, and are most suggestive facts as to the relation existing between nucleus and cell-body, and while not proving that protoplasmic phenomena may take place independently of the nucleus, yet show that the nucleus does not dominate all cytogenic phenomena.—T. H. M.

[5] *Anatomischer Anzeiger*, VI. Jahr., Nos. 9 and 10, 1891.

crossed. The little fish is at this stage so large that the double nature of the mouth involution may be seen without aid of a lens. The author is not committed as to whether the breaking through of the ventral region represents a pair of gill-clefts,—*i.e.*, as to whether the Teleost (and vertebrate) mouth arises, as Dohrn supposed, from a ventral fusion of a pair of fused gill-clefts.

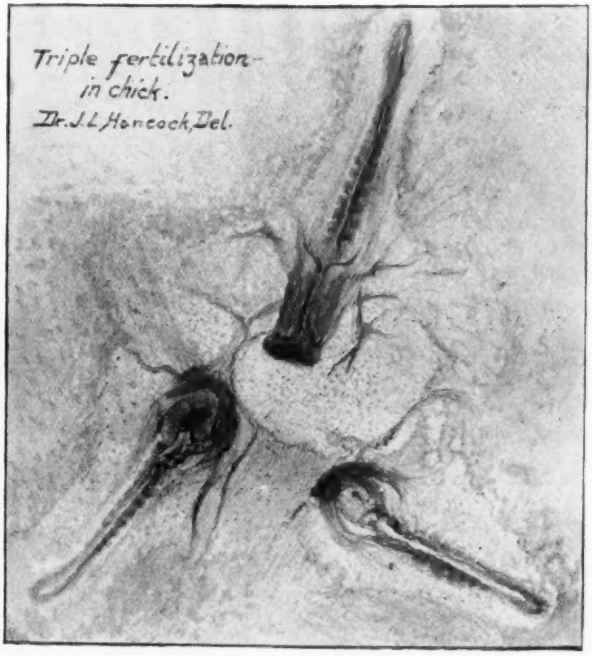
Triple Fertilization in Egg of Domestic Fowl.—The infrequency with which triple fertilization takes place in the same ovum, in birds or mammals, is in itself reason for presenting to the scientific student what appears to be a unique specimen illustrating this phenomenon, and upon which may also rest the basis of certain biological speculations. In view of this I have drawn the specimen (see Plate XXII.), shown for the first time, representing topographical features rather than histological detail.

The literature at my disposal and such inquiries as it was possible for the writer to make from reliable sources failed to recall another recorded instance of triple fertilization occurring in domestic fowl. It is in this connection interesting to note that Hertwig, Fol, Pluger, and other observers of note are unanimous in the conclusion that "polyspermy," or more than one spermatazoa entering the ovum, is extremely rare, and, as a matter of fact, generally impossible; and where it does occur in rare conditions, it indicates a pathological condition of the egg-cell, giving rise to the production of abnormalities.

Here we have, in all probability, the entrance of three sperms into the ovum,—a condition indeed so rare as to excite more than ordinary interest in the mind of the naturalist.

I am indebted to Dr. J. C. Millman, formerly in the biological laboratory of the University of Wisconsin, for the generous spirit with which he brought to my notice and allowed me the pleasure of laying the specimen before the reader.—Dr. Joseph L. Hancock, *Chicago, September 29th, 1891.*

PLATE XXII.



TRIPLE FERTILIZATION IN EGG OF DOMESTIC FOWL.
(About thirty-eight hours old.)

ARCHEOLOGY AND ETHNOLOGY.[1]

The International Congress of Anthropology and Prehistoric Archeology of Paris, 1889.—(*Continued from page 844.*)—SEANCE LIBRE.—*Questions—First Question:* "The Existence of Man During the Tertiary Period."

M. Boule presented a photograph of the under jaw of the *Dryopithecus fontani*, found in the Miocene of Saint-Gaudens, Haute Garonne.

M. Delgado, at the head of the Museum of Archeology at Lisbon, presented a collection of flints gathered at Otta, Portugal; thirty came from the Tertiary sandstone and twenty-four came from the surface, and the discussion turned to the existence of man during the Tertiary epoch. He contended that those from the deposit at Otta were really and truly Tertiary, but that the pieces of flint from the surface correspond to those which had been found at Otta by Ribeiro, and, consequently, they were not those which came from the Tertiary.

M. Gabriel de Mortillet praised the method of searching which M. Delgado had pursued. The fact that M. Delgado had once been unable to find the worked flints in the Tertiary deposit proved nothing to his mind, for these worked silex were comparatively rare. There had never been many of them found, and the series such as presented by M. Delgado of twenty-four were about as much any one had been able to find. In the richest deposits of the Quaternary period one can search for days and days and cubic meter after cubic meter of the gravels without finding a single instrument therein, and yet this work, if continued long enough and extended over sufficient territory, as is done in the railroad and canal cuttings at Chelles and at Saint-Acheul, demonstrated the fact that they are in existence in these deposits by the hundreds and even by the thousands.

A lengthy discussion ensued over the methods employed by prehistoric man in the working of silex, illustrated by drawings by M. A. de Mortillet, criticised by others, showing the cracking of flint by the heat of the sun, exposure to the air, by fire, by percussion, and by pressure. M. Docteur Capitan presented a full series of the implements used, and gave a practical demonstration of the methods employed. He had the percuteur or hammer with and without the intervention of a punch, which might be by stroke, direct or indirect, as the anvil, the nucleus, the flake. The primary work was done usually

[1] Edited by Dr. Thomas Wilson, Smithsonian Institution, Washington, D. C.

by percussion, but some of the small and fine flakes, such as those of obsidian made by the Mexicans, were possibly made by pressure.

"A flake, larger or smaller, once obtained, was subjected to secondary work by which it was made into the arrow or spear-head, knife or hatchet, according to the intention of the maker and the possibilities of the material. This was done by secondary chipping,—that is, chipping the flake, called in French retouching: 1, by percussion; 2, on the anvil; 3, by pressure; 4, by hammering or pecking; 5, by grinding or polishing. For the pressure a bone implement from paleolithic Grotte de l'Eglise, evidently much used, belonging to the collection of Dr. Capitan, was exhibited.

Which and how many of these methods were employed can only be determined from an inspection of the specimen, the condition in which it was found, and the objects associated with it. From these elements were to be resolved the question as to the man who made the implement and the age or epoch to which he belonged. All but the last two methods were employed alike during both the paleolithic and neolithic periods, while the last two were peculiar to the neolithic.

M. Gabriel de Mortillet, and at the end Belucci and Vilanova, all sustained the proposition that there were proofs of the existence of man during the Tertiary epoch. This was combated by M. Cartailhac, Boule, and Rames.

Monsieur Macedo put up the question of the discoveries of prehistoric human remains at Castenedolo, in Lombardy, Italy, which provoked a discussion by MM. Topinard, de Mortillet, and Cartailhac. Reports in the *Anthropologist*, that the largest investigations made by M. Arturo Issel, of Genoa, adopting the opinion of the geologist, Stoppani, confirms him in the opinion that neither the ancient nor the new skeletons or cemetery at Castenedolo belonged to the Tertiary man.

Second Question:—"The Mines and Workshops of Flint."

M. de Baron de Loë read, on behalf of himself and M. de Munck, a notice upon the excavations recently made in the neolithic *atelier*, or workshop at Spiennes, near Mons, Hainault, Belgium. This memoir added a number of interesting things to those which had already been recorded by MM. Cornet, Briart, and Houzeau de Lehaye at the meeting of this Congress in 1879 in Brussels. The result of the investigation of MM. Loë and de Munck into these wells or shafts of the mines of flint in Spiennes showed that being brought on the surface the flint was wrought in special workshops in the neigh-

borhood, which were without necessary connection with the mine, and shown by slight depressions full of broken and incomplete pieces and chips and flakes, the débris of the shop. Worked objects of deer horn and bone were found, and the pottery was fine and well modeled. The workshops may have been huts occupied as habitations, more or less temporary, by the workmen. They were probably made of some light material, of which the traces are still found on the surface. The special characteristics of the objects found in these workshops showed that there had been a division of labor, and that each workman confined himself largely to the manufacture of a single implement. These workshops had furnished prehistoric flint implements to Hainault, Brabant, and possibly to the North of France.

M. de Munck insisted upon the last point. He had found fifteen neolithic stations in direct relation with Spiennes, which were divided among forty-five communes. The location of these workshops had given rise to a network of roads of communication that have remained in usage for a long time after. M. de Munck prophesied that searches of the same order, if pursued in other places and localities, and with other materials which composed the industries of the age of stone, would give results of much interest and benefit.

Mr. Thomas Wilson continued the discussion by a description of the quarry at Flint Ridge, near Newark, in Licking County, Ohio. In a space ten miles long and three miles wide had been found a thick bank or stratum of silex from four to twelve feet in thickness, which the aborigines had attacked by means of wells dug through the surface soil and clay. After piercing this soil or clay they broke down through the stratum of silex by means of fire, and extracted it in great blocks. The flint which was thus obtained was broken up in its place, and was spread around over the surface of the entire plateau, where its remains were found in many workshops, and the implements thus made were to be found disseminated throughout the entire state of Ohio.

M. Cartailhac described the exploitations made by himself and M. Boule in the mines of flint at Mur-de-Barrez, in Aveyron, of which he had given reproduction which was exhibited at the exposition. He said that similar wells or shafts had been found by Baron de Baye in the Department of Marne, and also many years since by Cuvier and Brongniart in the Chalk of Meudon.

Prince Poutjatine, one of the delegates from Russia, presented to the congress a superb collection gathered from the north of Moscow, near Bologoje, district of Waldai, province of Novogorod. There were a number of polished stone hatchets of various dimensions, but

generally small; worked flint in the form of points, arrow-heads and others; worked bones, arms, tools, pendeloques, ornaments, harpoons, a fish-hook in two pieces worked with a joint. He has many fragments of pottery, which had been decorated as is common among the Indians of North America; that is, by pressing upon the soft clay certain textile fabrics, strings, cords, twine, etc., which made the ornamentation.

The Prince has sent to the U. S. National Museum a series of casts, as well as several original pieces of prehistoric pottery, all decorated as above described. These were exchanged for a series from the United States. The similarity of these two series so widely distant is remarkable. The astonishment of the beholder is increased when he is told that heretofore this mode of decoration was believed to be confined to the United States, and that none except that here described have ever been reported from Europe.

The Prehistoric Man of Spy.—Among the most interesting exhibits at the recent meeting of the International Geological Congress at Washington was that of M. Max Lohest, of Liége, Belgium. Although unfortunately M. Lohest's paper was crowded out, and consequently the members had not the advantage of hearing it, yet his photographs and pamphlet were examined by several of those who combine archeology with geology.

M. Lohest's paper read before the Anthropological Congress gives an account of his investigation in the grotto of Spy, near Namur, on the property of the Count of Beauffort. In this cavern M. Lohest found, under a thick bed of rubbish and fallen fragments of limestone, three distinct ossiferous beds. The uppermost of these was in part stalagmitic, and contained a few bones of an undetermined deer, a bear's tooth, and some pieces of the bones of the mammoth. Besides these, and mingled with them, were great numbers of flint implements of various patterns, some of them resembling the type known as "Mousterien," from the cavern of that name, and others are like those found in the well-known Engis cave in Belgium. Some are notched like saws, and of very thin and delicate workmanship. They consist of scrapers, points, blades, knives, etc., worked on one face, some apparently to be set in handles, and others not.

No instruments of bone or of ivory were found in this upper layer, and the flints are mostly covered with a white or bluish patina, sometimes very thick.

Under this stalagmitic layer was a second ossiferous bed, usually red from the presence of iron ore, many fragments of which were found.

Here occurred the following fauna: *Rhinoceros tichorhinus*, abundan; *Equus cabalius* (horse), very common; *Cervus elaphus* (red deer); *Cervus canadensis?* (elk); *Cervus megaceros* (Irish elk); *Cervus tarandus; Ovis aries* (sheep); *Bos primigenius* (bison); *Bos priscus* (aurochs); *Elephas primigenius* (mammoth), very abundant; *Ursus spelæus* (cave bear), scarce; *Meles taxus* (badger); *Canis vulpes* (fox); *Canis lupus?* (wolf), *familaris?* (dog); *Mustela foina* (weasel); *Hyæna spelæa* (cave hyena), very abundant; *Felis spelæa* (cave lion), a few teeth; *Felis catus* (cat); *Sus scrofa* (pig). These determinations are due to M. Fraipont, professor of paleontology at the University of Liége. Numerous hearths were also found on this layer, composed of stones, and containing burnt wood and ashes.

The materials used by the old inhabitants of this grotto were flint, phthanite, sandstone, chalcedony, opal, ivory, bone, and horn, and the total number of implements obtained was very large. There are 140 "Mousterien" points, most of them thick at the base and not intended for setting in handles, whose average dimensions are four inches long by three inches wide; a number of fine flakes and awls, and arrows or dart-heads, of very fine workmanship, some of them five inches long, resembling in type the "solutreën" implements of the Dordogne, a single small core from which flakes have been taken, and numerous blocks rejected on account of some defect after a flake or two had been struck off, and 300 scrapers of various size and types.

Implements, etc., of ivory were more numerous in this layer than in any other cave in Belgium. Chips were so abundant as to form a breccia in one place. The objects found were for the most part for dress or ornament, and the material had often degenerated into a chalky substance. Many of them were unfinished, or the different stages of manufacture were revealed. Some of them were marked with striations, as was also the case with the implements of horn and of bone found with the ivory. On a rib of the mammoth or rhinoceros was found a series of "circumflex accents" ranged one above another, of which a figure is given in the pamphlet. One hollow horn was filled and stained with iron oxide, and is supposed by M. Lohest to have been a receptacle of this material for coloring the persons or the implements of the cavern. These with four fragments of pottery, found by another investigator, complete the list of relics from the second ossiferous layer.

The third contains a fauna, so far as it goes, identical with that of the second bed. *Rhinoceros tichorhinus*, abundant; *Equus caballus*, very abundant; *Cervus elaphus*, rare; *Cervus tarandus*, rare; *Bos primigenius*, common; *Elephas primigenius*, common; *Ursus spelæus*, rare; *Meles taxus*, rare; *Hyena spelæa*, abundant. In this bed were found, as in the other, abundance of flint implements, but somewhat different in form and material from those above mentioned. The great interest of this layer, and, indeed, of the whole find, is the discovery not only of the works of man, but of man himself, in the form of two partial skeletons, one skull of which is nearly complete. This, of course, forms the central point of M. Lohest's paper, and he justly goes into detail concerning it. We will condense his account, written by Dr. Fraipont:

"The human relics belong to the most ancient fossil race, that of Neanderthal or of Canstadt. The skulls, fairly complete, present all the ethnic characters of that race, whose remains are known from France, Italy, Austria, Germany, and Sweden. Hitherto only a single jaw has been obtained from a cave (Naulette) in Belgium."

One of these skulls is apparently that of an old woman; the other that of a middle-aged man. They are both very thick. The former is clearly dolichocephalic (index 70), the other less so. Both have very prominent eyebrows and large orbits, with low, retreating foreheads, excessively so in the woman. The lower jaws are heavy; the oldest has almost no projecting chin. The teeth are large, and the last molar is as large as the others. These points are characteristic of an inferior and the oldest-known race. The bones indicate, like those of Neanderthal and Naulette, small, square-shouldered individuals. M. Lohest adds:

"The skeletons from Spy are among the most important discoveries relating to the oldest-known race of men. The cave shows three ossiferous layers, and remains of the mammoth occur in all three. Stone implements chipped only on one face indicate the 'Mousterien' type of industry.

"The relics of the three layers indicate an advance in the character of the workmanship.

"The second layer, by its association of chipped tools with ornaments of ivory and bone, shows its close relationship to the 'Mousterien' type, and, at the same time, is free from all suspicion of accidental mixture.

"The study of the bones of the lowest level proves beyond doubt that the earliest race of men as yet known in Belgium had a skull of

the type 'Neanderthal,' and used instruments of the 'Mousterien' pattern."

In the above discovery we have at least clear and indisputable traces of the men whom up to now we have known almost entirely by their tools. A few disjointed bones not free from suspicion are now fortified by evidences that cannot be gainsaid, and the old Canstadt or Neanderthal race stands before us as an extinct but real ancestor.—*American Geologist, Sept.*, 1891.

M. Max Lohest made several visits to the Department of Prehistoric Anthropology during the International Geological Congress, and we had much pleasure in renewing acquaintance formed years ago. I had visited the Grotte de Spy along with the other Belgian prehistoric caverns, and was acquainted with his work. He had a full display of objects from these caverns at the French exposition, and read a paper before the International Congress of Anthropology and Prehistoric Archeology.

Not the least interesting episode of the geologic congress were the visits of Professor Gaudry and Marcellin Boule to the Department of Prehistoric Anthropology. They are both, like M. Lohest, much interested in the antiquity of man, and many things shown them ill appreciated by the American public were regarded by them with intense eagerness and interest.

Continuation and Close of Proceedings of American Association for Advancement of Science.—*September 30th.*—Saturday was the last and most attractive day of the meeting. It opened with a most interesting paper by Mr. Frank H. Cushing upon the outlines of Zuñi creation and migration myths in their relation to the Ka-Ka and other dramas or dances. It was carefully written, well delivered, and was a valuable contribution to the history of these Indians. The illustrations displayed were elegant, and as the paper will be published in due course, it is deemed wise not attempt a description.

Mr. James Mooney gave an impromptu and extemporaneous description of the Messiah religion and the ghost dance. Mr. Mooney spent some months among the Apache and Kiowa Indians, and had just returned with his trunk full of Indian relics and his head full of Indian stories, myths, and traditions. He had witnessed the ghost dance many times, and had innumerable photographs illustrative thereof. He did not attempt to read a paper. He talked, acted, and danced. He roused his audience to a pitch of enthusiasm rarely seen in a scientific

assemblage. Mr. Mooney stated that the present Messiah excitement is not the first of its kind among the Indians, and is not even peculiar to the race. It is only another expression of the universal longing for a happiness that died when the world was young, and a faith that in a time yet to come we shall be able to close our eyes upon present miseries and waken again to the realization of the old ideals. The Messiah doctrine is born of the despair of the Indian, who finds himself helpless and starving before the white man, and sees no hope but in the direct interference of a redeemer of the red race, who is invoked in the wild ceremonial of the ghost dance. The present agitation originated among the Poütes in Nevada, and was carried by native apostles to nearly every tribe of the plains and mountains from the British border almost to Mexico. The belief is that the whites are to be dispossed, and that the land will be restored to the Indians, together with the buffalo and other game and all the old-time Indian life. There are various theories as to how this will be accomplished, the favorite one being that a new earth, upon which are all the dead Indians, the buffalo and other game, will come, preceded by a wall of fire, and slide over this old world. The believers will be lifted up over the wall of fire by means of the sacred crow feathers which they wear on their heads, while the whites will be driven before the fire to the eastern land across the the water from which they came. In the dance they pray for the speedy coming of their deliverance, and sing of the old pleasures of the hunt and the camp, and of their present miserable condition. These songs are all plaintive in tone, and many of them are really beautiful. The great majority are in the Arapaho language. Those who become unconscious in the trance—through the intense nervous strain and the hypnotic action of the priests—catch glimpses of the glory to come, and on awaking recite these visions in songs which are taken up at the next dance. As many as a dozen frequently become unconscious in a single night, and lie for hours perfectly rigid upon the ground.

The following papers were considered as read by title and passed for want of time: An Ancient Human Cranium from Southern Mexico, F. W. Putnam. The Length of a Generation, C. M. Woodward. Burial Customs of the Hurons, Chas. A. Hirschfelder. Study of a Dwarf, Frank Baker. Stone Drills and Perforations in Stone from the Susquehanna River, Atreus Wanner. Evidences of the High Antiquity of Man in America, Thos. Wilson. On Bone, Copper, and Slate Implements Found in Vermont, G. H. Perkins. Some Archeological Contraventions, Gerard Fowke. On the Distribution of Stone

Implements in the Tide-Water Province, W. H. Holmes. Aboriginal Novaculite Quarries in Arkansas, W. H. Holmes. Games of Teton Dakota Children, James Owen Dorsey. Geographical Arrangement of Prehistoric Objects in the U. S. National Museum, Thos. Wilson. Curious Forms of Chipped Stone Implements Found in Italy, Honduras, and the United States, Thos. Wilson. Inventions of Antiquity, Thos. Wilson. Study of Automatic Motion, Joseph Jastrow. Race Survivals and Race Mixture in Great Britain, W. H. Babcock.

SCIENTIFIC NEWS.

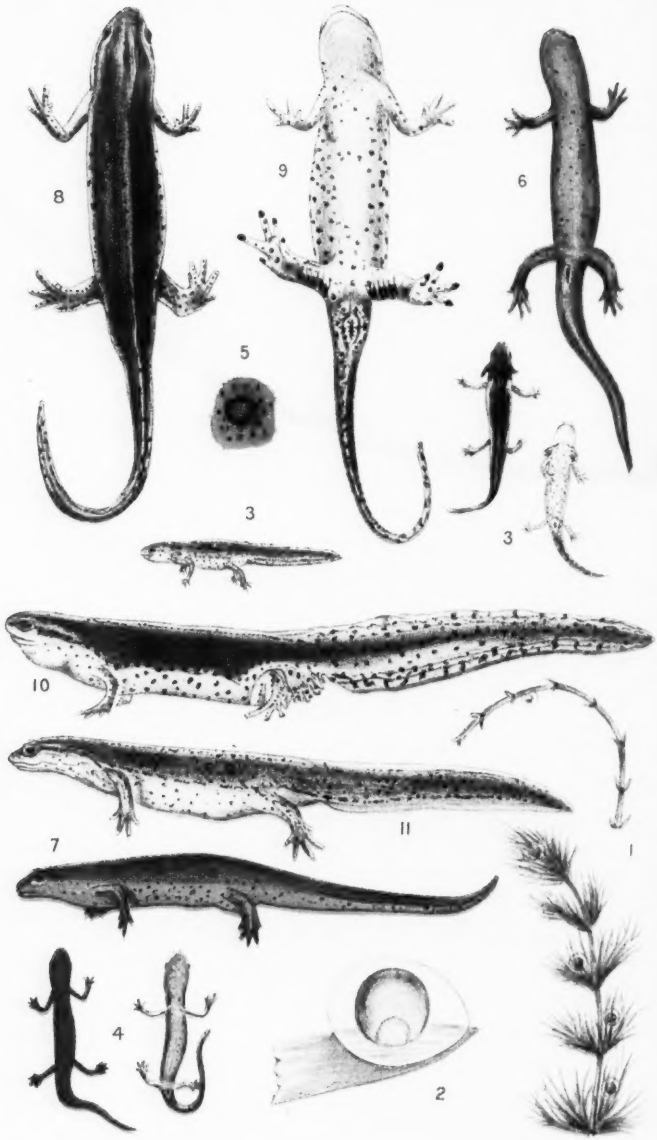
The Ninth Congress of the American Ornithologists' Union will convene in New York city on Tuesday, November 17th, 1891, at eleven o'clock A. M. The meetings will be held at the American Museum of Natural History, Central Park (77th Street and Eighth Avenue).

Philip Herbert Carpenter, M. A., F. R. S., died October 23d. He was born in London, February 6th, 1852; was educated at Cambridge, and in 1877 was appointed assistant master at Eton College. In 1868 he was a member of the scientific staff of the deep-sea exploring expedition of H. M. S. Lightning, and was with H. M. S. Porcupine, in the same capacity, in 1869–'70. In 1875 he was appointed assistant naturalist on H. M. S. Valorous, which accompanied Sir George Nare's Arctic expedition to Disco Island. In 1883 the deceased scientist was awarded the Lyell fund by the Geological Society of London, and in 1885 he was elected a fellow of the Royal Society. He was the author of a number of valuable works, including a "Report Upon the Comatulæ Dredged by the United States Survey in the Caribbean Sea," published last year.

At the meeting of the Academy of Natural Sciences of Philadelphia, on October 20th, the committee on the Hayden Memorial Geological Fund reported that they had decided to award the Hayden medal and accompanying fund this year to Professor Edward Drinker Cope, in recognition of his researches in the domain of geology and paleontology. This is the second award of this medal of honor, the first having been made to Professor James Hall, the veteran geologist of New York, and pioneer in the field of American paleontology.

The Bulletin of the Essex Institute just issued (Vol. XXIII., Nos. 4, 5, and 6) contains the retrospect of the year 1890–'91. From it we learn that the total additions to the library number 19,102, of which 2,638 were bound volumes, 6,994 pamphlets, and 9,470 serial. The receipts for the year were $6,708.71, and the income-earning property, $71,269.10. Nine members have died during the year.

Dr. Martin Heidenhain is Prosector of Comparative Anatomy in the University of Würzburg.



DIEMYCTYLUS VIRIDESCENS RAF.